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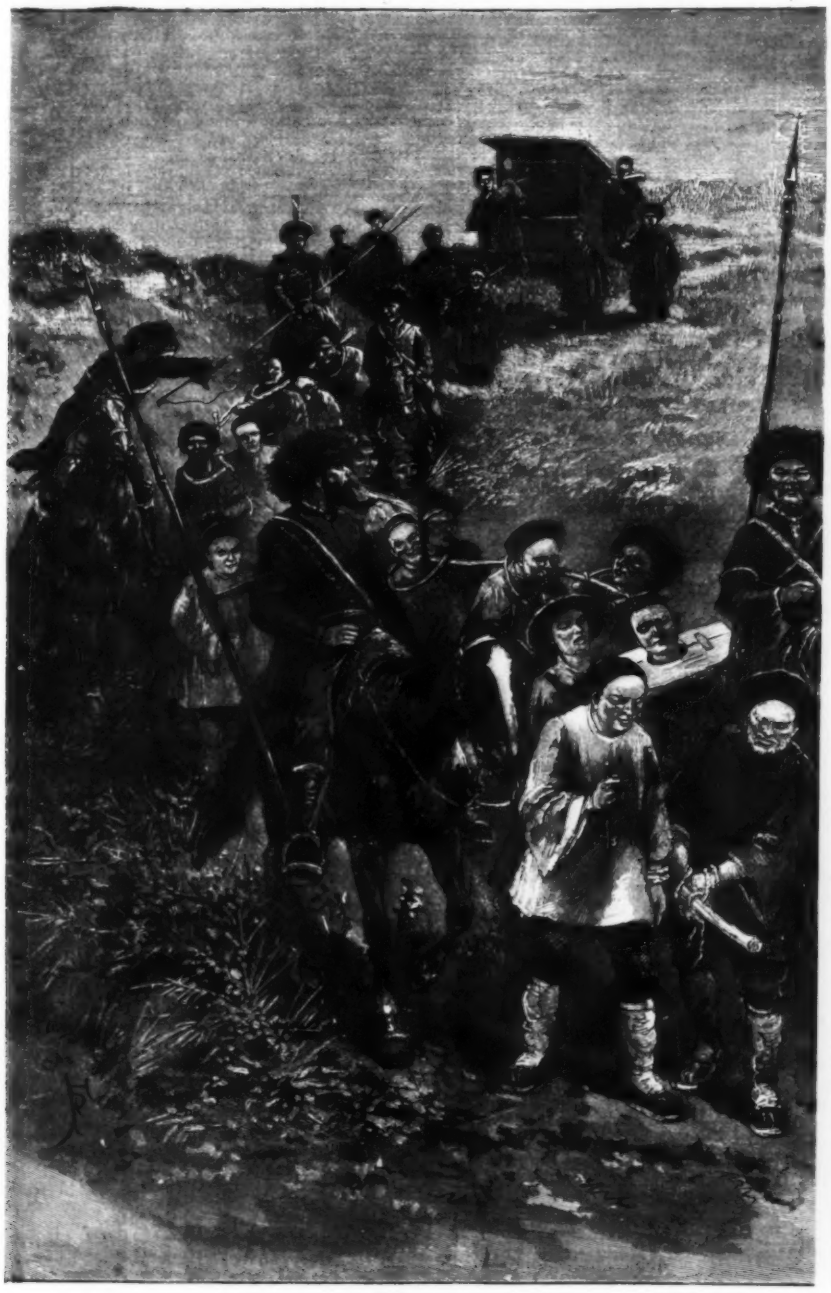
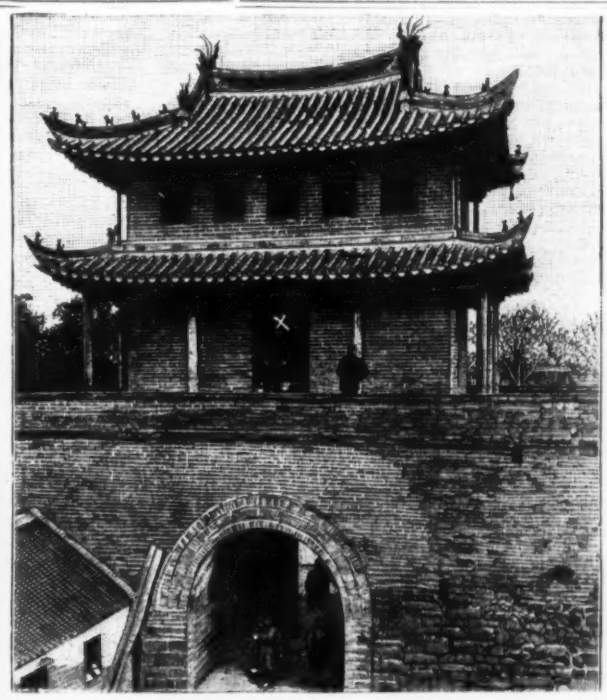
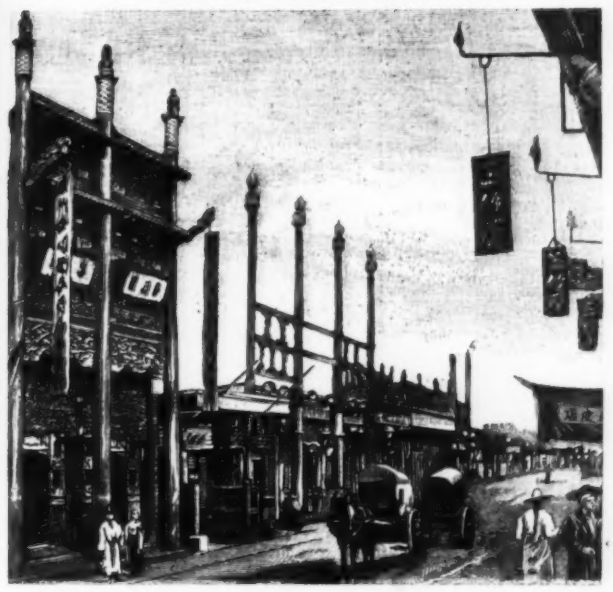


RECRUITING FOR THE CHINESE ARMY.



TEMPLE ON THE WALL OF TSIMO.



A STREET IN PEKING.

THE CHINESE WALL NEAR KULDSCHA.

CHINA AND THE CHINESE OF THE PRESENT DAY.

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CHINA AND THE CHINESE.

FORTY miles from Taku is Tien-Tsin, the port of Peking, which is eighty miles distant by road. It is on the river Pei-Ho. Steamers of light draught and gunboats manage to get to the bund in front of the foreign settlements, but they are often stuck in the river for days. The foreign settlements have good streets and fine houses. The Chinese have built a large naval college just below it, but the native city is like all Chinese towns, dirty, with narrow streets. It is a very busy and important city; everything from the south has to pass through it. Here Li Hung Chang, the Viceroy of Chili, has his Yamen, and spends more of his time than in Pao-ting-fu, which is the capital of Chili.

The river divides the town, and the banks are lined with junks three and four deep, unloading grain and transshipping it into smaller junks for Peking. All the grain from the junks and steamers is transshipped at Tien-Tsin. All the machinery required to move this immense mountain of rice and millet is simply an army of coolies, a lot of wooden boxes for measures and a number of reed mats; the grain is emptied, measured, sacked and sent off, the mats are picked up, and the work is done.

At the top of the reach is the debouchure of the Grand Canal, which swells the waters of the river and makes it broad and rapid.

Until February, 1898, no foreigners could travel in the empire except to certain named points—usually the treaty ports. But now all foreigners who have passports may visit any part of the empire on pleasure or business, and vessels may navigate the streams tries entered the empire. The treaties stipulated that foreigners should have the right to live at these ports, but the privilege covered only a certain part of the place. This, it was stipulated, should be under the control of the foreigners residing within it, and this rule has continued to the present time.

The roads of China are poor. Only a few are paved, and for that reason the greater part of the trade is carried on by means of the numerous canals and other waterways. The country is irrigated by great rivers, and intersected by a system of canals which is more than six hundred years old. But these canals, like the roads, the army, and everything of a public character, are badly managed and in a state of decay. The Grand Canal, the longest artificial waterway in the world, starts from Tien-Tsin and runs south to Hang Chow, a distance of 600 miles.

Lord Charles Beresford in speaking of it said that when he saw it in 1898 there was no water in it, pigs were wallowing in the bed, which was actually dry, and it was silted up where it should join the Yang-tse, simply from want of care.

The Yang-tse River, nearly 3,500 miles long, is navigable in the summer, which is the flood season, for a distance of 680 miles, from the sea to Hankow, for ocean-going vessels. Ordinary steamboats can go 370 miles further upstream.

The whole empire has only 317 miles of railroad. The longest line is from Peking to Tien-Tsin, and thence to Shan-Haik-Wan, 300 miles, and the other is from Woosung to Shanghai. Russia is now building 1,400 miles of road; Belgium, 700 miles; and China is building on her own account a line of 170 miles. Ground has been surveyed for 2,507 miles additional. Of these

WAN-SHU-SHAN, SUMMER RESIDENCE OF THE EMPEROR OF CHINA.

of the various provinces. Under the treaty of Shimonosiki, entered into with Japan in 1895, further concessions were made, and foreigners were permitted to establish manufacturing branches at the treaty ports, and with that end in view, to bring their own machinery.

The greatest source of revenue for the provinces is the duty on goods coming over their lines from the adjacent provinces. These duties are known as "likin" duties, and they must be paid not only for taking goods from one province to another, but from one sub-division to another. This makes the taxation extremely heavy. To get around this, and to save the trouble and cost of frequent examination, the Chinese government agreed to allow foreigners to send their goods to the interior free of "likin" taxes by paying an additional 50 per cent. on the customs tariff. The foreign merchants agreed to this willingly, but the provincial tax collectors frequently ignored the agreement, and insisted on their revenues, and the 50 per cent. became much more before the goods reached the trader.

In 1784 the first American trading began and continued through "hong merchants" (native middlemen) until 1843, when the "hong" system was abolished and the doors of China were partly opened for direct trade with other nations. The change was brought about by the opium war between Great Britain and China in 1840. The treaty of 1842 opened Shanghai for commerce and residence to British subjects, and a similar treaty was made by the United States in 1844. Canton was opened in 1859, other ports followed, and in 1862 there were twelve treaty ports. These treaty ports, which are now frequently spoken of, were simply the doors through which the goods from other countries entered the empire. The treaties stipulated that foreigners should have the right to live at these ports, but the privilege covered only a certain part of the place. This, it was stipulated, should be under the control of the foreigners residing within it, and this rule has continued to the present time.

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All the principal cities in the empire have telegraph service. An arrangement was made with the Russian telegraph authorities in 1892 by which communication was established between Peking and Europe.

The postal system of the empire is still in a primitive condition. It is carried on under the direction of the Minister of War by means of post carts and runners. There are eight thousand offices for post carts in the eighteen provinces, and there are 2,040 offices for runners scattered over the empire. There are also many private postal couriers, and during the winter the foreign customs office maintains a service between Peking and the outposts.

The capital of China differs from any other city in the world. It has no towering spires or graceful minarets, no lofty chimneys or high monuments, no fine buildings or houses eight or ten stories high, to be seen in the distance and to notify the traveler that he is nearing the city; nothing is to be seen from the outside but the walls, and these are hidden by the houses and trees in the suburbs.

Peking is in the form of a square four miles on the side. There are nine gates in the outer walls; two on the east side, two on the north side, two on the west side, and three on the south wall, which divides the Tartar from the Chinese city. About a mile inside these walls in the center of the city is another walled city, called the Imperial city; again, inside this city is another walled city, called the Forbidden city, and inside these again are the palaces. Here the Emperor lives; "such divinity doth hedge a king." No foreigner is allowed inside the Forbidden city. The Chinese city is tacked on, as it were, on the south, and extends for about half a mile east and west beyond the wall of the Tartar city. This is also inclosed by a wall about nine miles round, pierced for seven gates. It is smaller than the other, and built 100 years later. The Chinese city is much inferior to the Tartar. There are no fine buildings except a few temples; the streets are narrow and very dirty. Each city is surrounded by a moat crossed by bridges at the gates.

The wall of the Tartar city is sixteen miles in circumference; it is fifty feet at the base, forty feet thick at the top, and fifty feet high. It is made of two thick outer walls, the space between being filled in with dirt dug out of the moat. There are no buildings in the city more than 90 feet high, as the natives say the spirit of the air flies at the height of 100 feet.

The moat which runs round the city is fed by springs running from the western hills, and as there are not many houses on the banks, the waters are fairly pure. All the principal streets running across the city, from the gates, are broad and unpaved; they are from 100 to 130 feet wide, but look wider, the lowness of the houses making them appear so; they are run in straight lines—north to south and east to west—a city of parallelograms. Nearly all the shops are in these streets, though, of course, there are some places busier than others. Between adjacent big streets are smaller ones, and lanes, in which are situated most of the private houses, which present nothing but a brick wall and a door to the street, the house lying back in its own compound. These lanes are very narrow and unpaved; there is hardly room for two carts to pass each other. As all the coal cinders and other refuse are thrown into the street, Peking is gradually burying itself in its own ashes. In parts of the streets, the center, where there is a hollow, a sort of causeway, about 20 feet wide, is made up from the dirt dug out from the sides, leaving great holes that take the surface water during heavy rains, and forming a convenient receptacle for miscellaneous slops from the houses and shops on the side.

Of all streets in Peking, the one of most importance to the world at present is the avenue upon which the ambassadors' and consuls' houses are located. Legation Street, as it is called, runs parallel and near to the south wall of the city. The whole of the legations and the inspectorate of Chinese maritime customs are within an area of half a mile. Nearly all are situated in parks surrounded by high walls. Nothing is to be seen from the streets but the gates and walls, except the British legation, which has built several two-storied houses, and the tops of these can be seen from some distance. The Russian legation is the oldest, having existed in Peking for over a hundred years. Near the legations are the principal government offices. Five of the six boards are on the east of the Imperial city, and one, the board of punishment, on the west. There is nothing particular to call attention to in these buildings; they are built in the usual Chinese style of one story and a large courtyard in front, with perhaps more than the usual quantity of dirt and dilapidation.

Following the canal by the front of the British legation brings one to the corner of the wall of the Imperial

city. It is about six feet thick and twenty-five feet high, and seven miles round; the top is roofed with yellow porcelain tiles. This is a characteristic of Peking. All the public buildings are covered with these glazed tiles, every dynasty having its own color, some green, some yellow. The present dynasty, which is the "ch'ing" or "pure," has adopted yellow. All the palace buildings are covered with tiles of this color. There is a moat inside the walls, crossed in various places by stone bridges. The city is entered by three gates, one in the east wall, one in the north wall and one in the west wall. These gates are inside a large hall; they are not closed at night. As the Emperor transacts all state business very early in the morning, mandarins are constantly coming and going, and when lazy people get up to go to business about nine in the morning, crowds of these courtiers and their suites are to be seen hastening home, after their early audience with the Emperor. About half a mile inside these gates are the gates of the Forbidden city, something like the large gates in the big wall of the Tartar city. In the center of the city is a hill about 300 feet high, said to be composed entirely of coal, for use in case of a siege. On the top are five pavilions, built during the Ming dynasty. It was here that the last Emperor of the Ming dynasty, finding all was lost, hanged himself —the Chinese say on a crab apple tree—and the tree can be seen to this day in chains.

On the south of this coal hill is a broad moat that encircles the Forbidden city, and on the other side are the walls; they are two and a quarter miles round, guarded by numerous stations of "bannermen." No one but Chinamen that have official business and wear official hats are allowed to enter; no person, whatever his position, is allowed to drive, ride, or be carried in a chair inside this city—all dismount at the gates. All this part of the city is just as it was left by the Mings in 1644. When the conquering Manchus swarmed in, they found a magnificent city and palaces all ready for them, uninjured and strong, which were apportioned among the victorious army for habitation. This army consisted not only of Manchus, but of Mongols and Chinese, and was divided into eight banners; thus they were called bannermen, and very few Chinese merchants were allowed to reside in the Tartar city. The Chinese, called "Min Jen," were obliged to live in the southern Chinese city. Partly by intermarrying among the banners of different nationalities, and, in much rarer cases, among the ordinary Chinese, the Manchu element has become almost absorbed, and the Manchu language, as a living tongue, has died out in Peking, though it is still used as the court language. Until within the last fifty years the whole population of the Tartar city consisted of bannermen, but now there are many Chinese among them. These bannermen are the virtual army of Peking, and it costs the government $800,000 every month to keep them on starvation pay. They form the whole of the police, amounting to 12,000 men, most miserably clad. They are the firemen, and also keep the streets in repair. As a class, the bannermen are lazy and proud; as soldiers, there is the making of good men in them if they were properly trained; at present they are worse armed and trained than any soldiers in China. Many are armed with bows and arrows. Skill in archery and great physical strength are deemed of more importance than any other attainment relating to war.

A road runs right through the palace gardens, crossing a fine lake by a marble bridge. On the banks of the lake are handsome summer houses and temples, beautiful groves and examples of the art of landscape gardening, in which the Chinese excel.

On the southeast side of the palace is the "Tai-Miao," the Temple of Ancestors. It is the family temple of the Emperor, and more honored than any religious structure.

There is a large Mohammedan population. All the sheep killed in the city are killed by Mohammedan butchers. There are also several mosques.

In the northeast of Peking is a most famous Buddhist temple, the Yung-Ho-Kung, or "Lamasary of Eternal Peace," where 1,500 Mongol and Tibetan priests study the dogmas of Buddhism, or spend their days in idleness, under the control of a Gegan or living Buddha.

The rehearsal of the prayers and chants by so many men is very fine and impressive. They chant the prayers and drink porridge out of a pail. There is a wooden gilded idol of Mait re ya, the coming Buddha, 70 feet high. There is a Buddhist Bible in this temple, unabridged, complete in 400 volumes.

The State religion, however, is Confucianism, although Buddhism and Taoism are recognized by the authorities. The Roman Catholic missionaries have worked with much success in China, and it is estimated that there are no less than one million Catholics in the empire. There is no ecclesiastical hierarchy, and there are no paid priests of the Confucian religion. The religion is really nothing more than profound respect paid to the memory of the great teacher. There is also the worship of Heaven (called Tien). This is a ceremony at which the Emperor, as the sole high priest, worships and makes sacrifice once every year.

The ceremony took place for centuries at the great Temple of Heaven, at Peking, which, with its courtyards and approaches, was one of the architectural masterpieces of the land. The central edifice, with its great porcelain dome, was of bright blue color. It was guarded jealously by the custodians, and only a favored few foreigners were permitted to enter the edifice, which was destroyed by fire a few years ago.

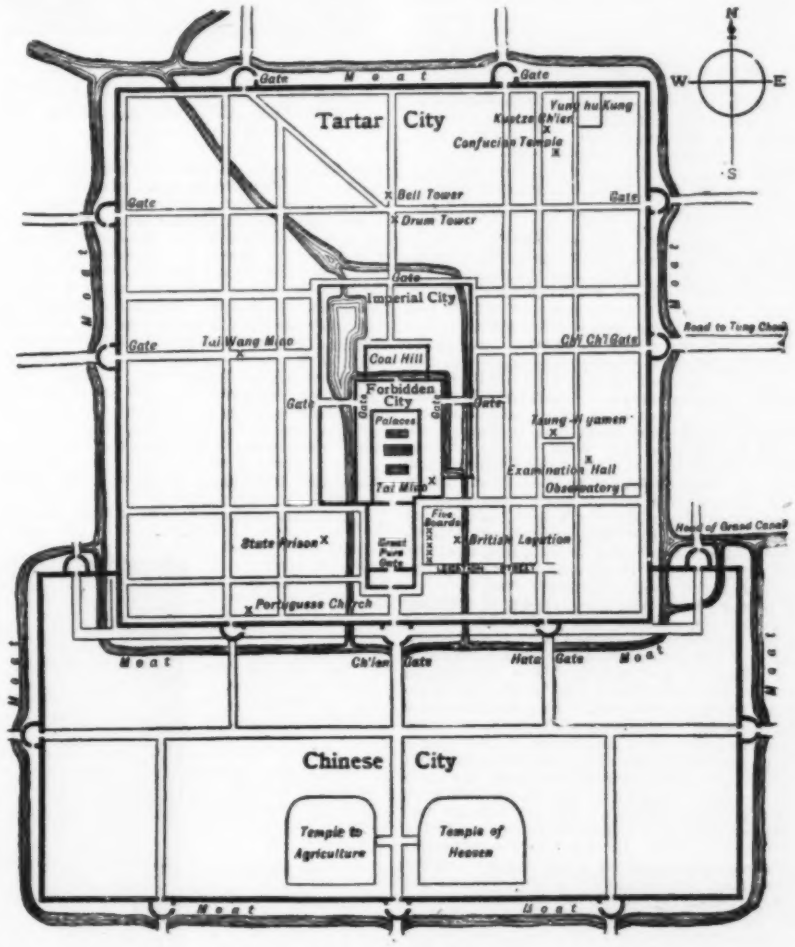
Confucianism as practised by the Chinese is little more than ancestral worship, with little outward ceremony, while the Chinese Buddhists have an elaborate and gorgeous ritual. The Chinese Taoists are the philosophers. There are many inhabitants of the empire, especially in the middle and southern parts, who profess and practice all three religions.

The first thought of the Confucian after arising is to worship. There is a shrine in every house, where a tablet with the names of ancestors is kept. There the householder does reverence to the memory of those who have preceded him, and prays that he may live so that those who follow him may hold his name dear. A rich man may have a separate building for this purpose, which is his hall of ancestors; the less wealthy may have a room set aside for the purpose, and the poor usually have only a shelf; and the humble paper on the dirty shelf is as sacred to its owner as the illuminated tablet in the gorgeous hall of a rich man's ancestors.

After the religious ceremony the Chinaman visits the barber, for keeping his head well shaved and his pigtail in proper condition is a duty which must not be forgotten. Until 1627 the Chinese wore their hair long and coiled on the top of the head, where it was fastened with an ornamental pin. But the Manchu edict making the pigtail a sign of loyalty changed this style, and now the barber is a necessity. He goes to the homes of the rich, but the poor men receive his attentions in the street.

There are few bearded men in China. Men who have grandchildren may wear a mustache, and many take advantage of the privilege and are called "old hair men." The foreigners with mustaches, when they came to China, excited much curiosity, and the unusual sight justified them in asking the ages of the bearded men.

A certain class which devotes itself exclusively to study forms the literary population, but the class is small, and it makes little or no impression on the great majority, in which intellectual enjoyments found in books and the conversations of learned men are unknown. The women occupy a low place in the Chinese world, and for these reasons the Chinese resort to the dice box, the opium pipe and to low places of amusement for their pleasure. This does not injure them in their standing with their peers. Those who wish to enter the public service belong to the literary class, and their fitness is determined by a rigid examination. The candidate for office appears before the examiners at the appointed time, and a series of questions is handed to him to answer. He is placed in a little cell, which resembles an ordinary sentry box. To protect himself



PLAN OF PEKING.

from the weather, and make the place more private, the candidate buys a piece of mat, and hangs it up in front as a blind. In each of these cells one candidate is shut up for two nights and one day, and not allowed to leave under any pretense. The food is cooked and supplied by men employed by the government, one coolie being allowed to ten men. The food is white rice only, any other luxury being provided by the students themselves. During the day of entering, the candidates flock in, and are searched by the numerous mandarins in attendance. No book or writing material is allowed inside; their places are allotted, and the gates closed. Then a committee of mandarins determine what the subject to be written upon is to be. This is handed to the wood block engraver, is cut, printed, and handed round to the different men, each question being the same. The candidate has a plain book handed to him with his name bound up in the cover, so that he is compelled to use the book supplied by the government. The subjects are quotations from the Chinese classics, a character or two only being given, the student having to take up the theme if he can. Candidates from all parts of the empire flock to Peking, and at the great examinations as many as 15,000 enter. Many die, and their bodies are thrust out through a hole in the wall provided for that purpose, where there are benevolent persons waiting to take the corpse and bury it at their own expense. The Chinese say that ghosts wander about at night up and down the alleys of cells, lifting the curtains and peeping into the little rooms; when the unlucky person is found against whom the ghosts have a spite, they rush in and strangle him. Common sense says it is a case of suicide. The candidate finding he cannot do the paper, and not having the courage to return to his village a failure, ends his life. When we think that out of this great number there can be only about 200 who can succeed, it will be seen how slight a chance there is for many. Yet all the examination halls throughout the land are always crowded, and if one considers the amount of mental toil which the mere entrance to any of these examinations involves, one gets a very vivid conception of the intellectual industry of the Chinese. In what land but China would it be possible to find examples of a grandfather, son, and grandson all competing in the same examination for the same degree? Many memorials have appeared in The Peking Gazette relating to the aged candidates. At the provincial examinations in one of the provinces 35 of the competitors were over 80 and 18 over 90 years of age! Could any country in the world afford a spectacle like this?

There may be differences of opinion as to many matters among the Chinese, but all visitors to that country agree that hatred of foreigners exists in all classes of Chinese society. The merchants and traders make strong efforts to conceal this characteristic, and like to throw the blame for the conditions on the lower and uneducated classes, and the same attitude is assumed by the official class, but polite terms and assurances of respect do not deceive the visitor, and he usually learns shortly after his arrival in the country that the "foreign devil" is unpopular.

The Chinese ideas have undergone a remarkable change in the last sixty years, and the foreigner has advanced wonderfully in their estimation in that time. He is still looked upon with misgiving and suspicion, but he has access to many parts of the country which only sixty years ago were closed against him. "Foreign dogs" were not wanted, the outside nations were not recognized, and foreign diplomats who wished to bring messages either of business or courtesy to the reigning monarch had to go through a long, tedious and humiliating process known as "kotow." This was to kneel three times before the Emperor or his representative, and then bump his head upon the ground nine times in token of submission and subserviency.

Since that time more than twenty cities and towns on the coast and in the interior have been opened, mining and manufacturing concessions have been extended to the world, and foreign business methods have come into use.

A few of the foregoing particulars have been taken from The New York Tribune.

NOTES ON JAPAN.

THE statesmen of Japan are not slow to see that relief from a prospective overcrowding of population can legitimately come only from those social and moral influences which check the birth-rate by raising the standard of intellectual life. This idea is largely coming to influence the educational system of the empire, especially as related to the education of women. At present the provision for the education of girls is far below that for boys. Beginning at six, the girls have four years of preparatory work, and then there are six years more open to them in the middle high schools, which correspond to our grammar grade. Naturally, therefore, their education would be finished at sixteen, and then the Japanese girl as naturally marries and at once becomes a factor in increasing the population of the already overburdened empire. Of course it is out of the question to prevent this by any arbitrary methods. The remedy lies in raising the intellectual stand-

ards of the common people, both men and women, especially of the women.

Strennous efforts are being made to do this, and with fair promise of success. According to the last educational report, there were 4,083,430 male and 3,647,011 female children of school age. Of these there were 3,066,278 male and only 1,716,482 female children in schools. But even this is a great increase in the ratio of female children in school over that of a few years ago. In the normal schools, also, the proportion is still more striking. While the males number 1,061, the females number only 224. In the ordinary higher schools for women there was, however, a gratifying increase from 2,026 in 1894 to 6,406 in 1897, but these figures would have to be greatly increased now, for the growth of the interest in the education of women has been increasingly rapid the last two years. This appears in the propositions before the Diet for the enlargement of such schools, in the increased attendance at the many private schools maintained by the various missionary societies (whose work in this direction is more and more appreciated by the Japanese) and in the societies for the promotion of literary culture among Japanese women. One such correspondence society has several thousand members, scattered over the empire, and publishes compendious summaries of information for the guidance of readers. In numerous addresses on scientific subjects given in Tokio and other large cities the presence of Japanese ladies of high rank was particularly notable.

The schools in general throughout the empire are the pride of the people, but it has taken some years to provide a suitable number of efficient teachers. A visit to the laboratories of the schools of several of the interior towns has, however, given me a high appreciation of the thoroughness of the education which is being provided for Japanese youth. The apparatus and working museums are fully equal to what one finds in places of equal size in the United States, while the preparation on the part of the teachers is probably somewhat more thorough. Certainly the geological and chemical instructors who accompanied us to the mountains were most thoroughly informed in their departments—not only familiar with local facts, but having a wide knowledge of the world, and minute information concerning the many problems upon which we conversed.

This thorough equipment for their special work is accompanied by a simplicity of character that is as charming as it is unusual. This was illustrated in a ride of some distance in a car with the professor of chemistry and physics to whom I have referred. When we had about exhausted our capacity for conversation on scientific subjects, on account partly of our imperfect understanding of each other's language without an interpreter, the professor opened his traveling bag, and drew out a carefully wrapped small parcel, which proved to be a mouth organ of German manufacture. He also unrolled a small music book used in the schools whereupon he entertained me with playing "Auld Lang Syne," "There is a happy land," and a few similar tunes. He was delighted to learn that I knew the words of "There is a happy land," and insisted that I should write them out for him. I afterward found that these tunes, with "Marching through Georgia," are special favorites all over Japan, and that the music of the mouth organ is specially prized by the children, who are often good performers upon it.

At several places I have had the privilege of meeting the leading educators, officials and philanthropists of the empire, and am deeply impressed with the strength and depth of the movement which is lifting Japan to the level of Western civilization. The civilization which they have borrowed from the West is not a veneer, as many have represented. The Japanese are building warships and fortifying their harbors after the most approved style, and are seeing to the organization and equipment of their army and navy (as their late war with China demonstrated) with all the thoroughness of Germany, and they are doing this with little aid from foreign engineers. The few foreign consulting engineers complain that they are consulted so little that life is a burden. In the interior, extensive works are planned and executed everywhere by native engineers to protect the fields from the devastating floods which descend with terrific force from the mountain slopes. Some of their mistakes have been serious, but they prefer to trust to their own ability, and experience proves a good teacher.

One is everywhere impressed with the vast amount of labor and engineering skill that was bestowed in former times upon fortifications and irrigating enterprises. More than one hundred fortresses surrounding as many castles where the leading Daimios lived, represent an enormous amount of labor and an equal amount of skill in adaptation to the defensive warfare of the time. In the aggregate the walls and moats exceed in amount that of the Chinese wall. All their national energy is now turned toward the accomplishment of more benificent purposes. In the olden times the family life was so strong that there were no orphans. Some relative was found to adopt each waif. But now this product of Western civilization is appearing in increasing numbers. An orphan asylum, under Japanese management, with all the natural paraphernalia of such an institution, was an interesting object of inspection in Okayama. There were here nearly two hundred children, under the best of discipline, receiving instruction in industrial as well as intellectual branches. They are also following our example in the establishment of reform schools for juvenile criminals, and in all other prison reforms. I found in Tokio two Japanese who have devoted all their energies to the work of caring for ex-convicts. In this they received the generous support of many noble Japanese families. More than eight hundred prisoners have been helped to independent means of employment, and nearly all had become respected members of society.

One can but be interested in studying the effects of the gradual introduction of labor-saving machinery into this dense population, and of the introduction of the gold standard, which was adopted three years ago. The general testimony is that, notwithstanding the introduction of machinery and steam transportation, wages have risen during the last twenty-five years about 75 per cent. and that reckoned on a gold basis. But even so, they seem to us ridiculously low, especially in official appointments. Postmen receive from four to six and a half dollars (in our currency) per month in the city, and from two to three in the country, and policemen only six dollars. But in both cases their uniforms are furnished by the government. Regular teachers in the elementary schools receive five dollars and a half per month, and in the middle schools seven dollars and fifty cents. In ordinary occupations, head carpenters receive from forty to fifty cents per day, under-carpenters from thirty to forty, while ordinary laborers receive from twenty to twenty-five cents. Trained nurses get thirty cents a day and their board.

But the prices of articles of necessity have nearly doubled during the last ten years, notwithstanding

M. DESLANDRES' EQUATORIAL AT THE MOMENT OF THE OBSERVATION OF THE ECLIPSE AT ARGAMASILLA, SPAIN.

the change in standard. This, however, is partly due to the fact that the gold standard was adopted by bringing everything to the silver standard as it was in 1896. But prices have risen rapidly since that time, thus demonstrating the fallacy of the silver agitators. The stability given to business has led to a rapid development of industries. This rapid rise, both in wages and in the price of living, must speedily bring about great social changes. Tokio alone has 50,000 jinrikisha men, whose sole dependence for a livelihood is upon pulling these convenient vehicles. The authorities look with trembling upon the effect upon these of the introduction of street cars, though the streets of a Japanese city are ill adapted to electric cars. They are so narrow and crowded that in Kioto a boy runs ahead at every street crossing to give the alarm. The jinrikisha, moreover, is so advantageous, in being able to come to every door, that the result is likely to be street cars and jinrikishas both, without diminution of demand for either.

A month in Japan is, of course, insufficient to give one more than a superficial insight into the complicated movements which are in progress everywhere. But it is doubtful if anyone has more than a superficial knowledge of the course of events in the empire, so rapidly are the changes proceeding. Prof. Chamberlain, who has been here thirty years, says significantly that he has already seen four hundred years of national life. I look almost with dismay at the prospect before me during the summer of plunging from this seething caldron of activity into the stolidity of China and the undeveloped resources of Siberia.—G. Frederick Wright in The Nation.

THE LATEST ERUPTION OF MOUNT VESUVIUS.

DURING the month of May the eruption of Mount Vesuvius, after a lull which had been mistaken for its end, began again with new vigor, affording a sight of impressive beauty. Natives and foreigners were attracted in great numbers to witness the volcanic phenomenon from as near a proximity as possible, and many of them advanced so close to the craters as to come in serious danger from the stones and lava emitted by the fiery mountain. A party of four Englishmen were overtaken by the lava, and had to be carried to Naples almost dead. Since then the government has had the approaches to the craters guarded by carabineers, who inexorably oppose any attempt of the curious to get too near the dangerous zone.—For our engraving we are indebted to L'Illustrazione Italiana.

THE ECLIPSE OF THE SUN OF MAY 28.

A SOLAR eclipse is an event of importance (an astronomical event is understood), for the time is now remote in which the momentary failure of the light of the "star of day" spread a holy terror; and what appeared to the ancients as a sinister omen, affords at present only an object of study to scientists and of curiosity to ordinary people.

As well known, it was to Spain that the majority of European astronomers went to observe the eclipse of the 28th of last May. The southwest coast of the peninsula offered peculiarly favorable conditions for the study of the phenomenon.

At Elche, especially, were stationed the mission of the Bureau of Longitudes of Paris under the direction of M. Maurice Hamy, the mission of the Vatican Observatory, under the direction of Father Prada, and the missions of the Toulouse and Montpellier Observatories. Among the French who were there were M. Camille Flammarion and Abbé Mareux.

The celebrated English astronomer, Sir Norman Lockyer, stationed himself at Santa-Pola, at 90 miles from Elche. For the maneuvering of the instruments, his government generously placed at his disposal fifty sailors of the "Theseus," which carried the English commission to Spain.

Very proud of his installation, Mr. Lockyer invited the French and Spanish astronomers to visit it, arranged a welcome, and assembled all the sailors in order to receive the delegations with proper respect; but, when the latter arrived, there was an eclipse, a total one, of the master of ceremonies, of the guard of honor, and of the apparatus, which had been carefully covered. M. Lockyer was ruffled at the delay of the guests; the latter in turn were put out by Mr. Lockyer's manner of doing things; and hence a bickering that threatened to develop into a national conflict. Is it common for so much sensitiveness to penetrate the soul of astronomers?

For several days, the telegraph had set the two worlds in a flurry by its dispatches, when it was found that the initial cause of the difference was a simple misunderstanding. Finally, after an exchange of courteous explanations, peace was made.

VESUVIUS IN ERUPTION—CARABINEERS DRIVING AWAY THE CURIOUS.

Other stations besides those above mentioned were established at Plasencia, near Madrid, and at Navalmoral and Argamasilla, where the French astronomer Deslandres was stationed and to which two trains of palace cars brought five hundred passengers, including a number of notable persons, among others the Infanta Isabella, Duke de Huesca, Minister de Villaverde, and the ambassadors of France, Italy and Austria.

Finally, the great day arrived. At the different stations strung along the line of totality, everything was ready, and scientists and spectators awaited the

precise moment, some with their professional calmness and others with feverish impatience. The serenity of the sky and the limpidity of the atmosphere promised a perfect view of the phenomenon.

At Elche, the total eclipse began at 3h. 59m. 1s. While it lasted, Mercury, Sirius and Mars shone with extraordinary brilliancy. The temperature of the blackened thermometer was 33 9/10° at 3h. 40m. and 20 1/10° at 4h. 25m. The white thermometer marked 29° at 2h. 40m., and 20 1/10° at 4h. 25m.

At Argamasilla and the other stations of the peninsula, the different phases of the eclipse were observed under the same excellent conditions. The public

JOHANNES GUTENBERG.

(FROM AN OLD ENGLISH PRINT.)

everywhere took the deepest interest in it, and, at the moment of total occultation, began to applaud as it would have done in the case of a successful theatrical effect.

As for the information obtained by the astronomers, that is divided into two distinct categories having reference either to direct observation or to photographic reproduction. It principally concerns the composition of the corona and the solar atmosphere as revealed by spectrum analysis, and the study of the small planets near the sun.

Let us mention by way of curiosity a collection of photographs taken with an automatic apparatus and capable of being applied to the cinematograph.—L'Illustration.

A BRIEF HISTORY OF EARLY PRINTING.

IN COMMEMORATION OF THE SEMI-MILLENNIAL ANNIVERSARY OF THE BIRTH OF JOHANNES GUTENBERG.

THE semi-millennial anniversary of Gutenberg's birth is to be celebrated in almost every city of Germany, but particularly in Mayence, the native town of the inventor of printing. The most recent investigations seem to show that 1397, and not 1400, should be regarded as the year of Gutenberg's birth, for which reason the festivities are three years late. Exactly when the first book was printed from movable type has never been accurately determined; for the title pages of Gutenberg's first books bore neither date nor place of publication. But by skillful research and the careful examination of old documents, it has been proved with reasonable certainty that Anno Domini 1450 (or possibly 1451) may be accepted as the date of the publication of Gutenberg's first book.

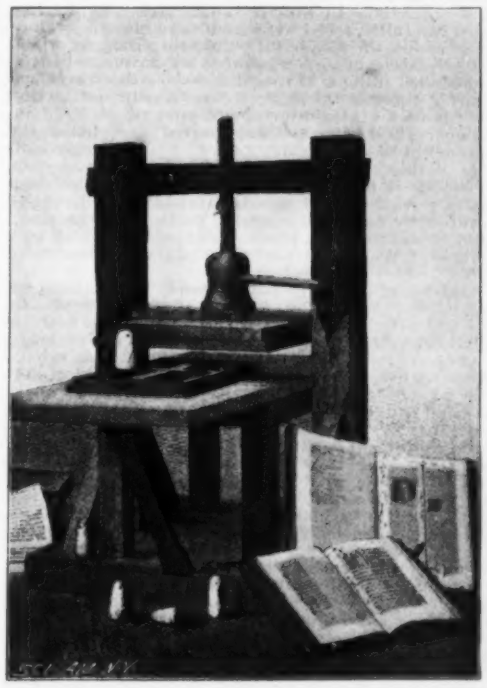
Of the life of Johannes Gutenberg little is known. He shared the lot of many inventors and thinkers, was underestimated by his fellow townsmen, and miserably paid for his great discovery. What a grateful posterity has succeeded in ascertaining of his struggles and experiences has been painfully gleaned, chiefly from court records, and legal documents of various kinds, in which his name is casually mentioned or he himself is a principal figure. And the most important of all such documents, a paper signed and sealed by a notary, on which Gutenberg's claim as the inventor of printing rests, was discovered but eleven years ago.

Little is known of the youth of the inventor, except that he was descended from a patrician family which can be traced in the records of Mayence back to the thirteenth century. His father, Frielo Gensfleisch, married Else Wyrich, through whom her husband received part of the Hof zum Gutenberg, from which the subsequent inventor of printing derived his name. After one of the frequent struggles between the guilds and the patricians for political power, one hundred and twelve of the foremost families of Mayence, in 1411, fled to Strassburg; among them was the family of Gensfleisch. Soon after, in 1420, the entrance of Kaiser Rupprecht and the newly-elected archbishop of Mayence, Johann, there was another violent struggle between the nobility and the burghers of the old town, with the result that the guilds secured very important privileges from the upper classes. Again there was an exodus of the nobility; and among the names of the men that left Mayence may be read that of Georg Gensfleisch von Sorgenloch, of all the nobles, the most cordially hated by the commoners. With Georg the whole family of Gensfleisch left town. Ten years later Archbishop Konrad drew up a compact, in accordance with the terms of which the exiled families were permitted to return. But Georg Gensfleisch was expressly excluded. In this compact Henschen zum Gudenberg (in other words, Johannes Gutenberg) is permitted to return, because he had taken no part in the Mayence feuds. His father died, probably, in 1430; and for that reason the boy could not seize the opportunity of returning to his native town. His elder brother, Frielo, remained in Eltville; his uncle, Henne Gensfleisch, returned to Mayence, but was unable to secure the old family residence, and was, therefore, compelled to seek other quarters in the city. Gutenberg's mother, Else, also came back to her old home; but she seems not to have lived at the Hof zum Gutenberg. The records which have been handed down show clearly enough that, in 1430, Johannes Gutenberg was not in Mayence.

In the fifteen years which follow, nothing is heard of young Gutenberg. It is said that he traveled during this time, but the proofs are so meager and so untrustworthy that no reliance whatever can be placed upon them. In 1434, however, he was in Strassburg, for, at his request, the city scribe of Mayence, the learned Niclaus, was arrested as a reparation for the 310 gulden which Gutenberg claimed the city of Mayence owed him for unpaid rent or interest. But although, in accordance with the custom of the times, the unfortunate Niclaus agreed to pay the sum, Gutenberg never received the amount claimed; for the city of Strassburg, not wishing to enter into a quarrel with Mayence, persuaded him to desist in his demands. He did so, but it was not, as he said, for love of his native town, but as a mark of respect and honor to the city council of Strassburg.

This adventure does not present the inventor of printing in a very favorable light. Nor is his character improved by the scandal which occurred three years later. In the records of the episcopal court, which have been preserved, it seems that a certain Ennele (Anna), "zur Isurnen Ture," had him haled before the judge to give some cogent reason for the breaking of the vow he had made to marry her. Gutenberg finally ended judicial proceedings by making her his wife. Nothing more is known of the married life of Gutenberg. The name of his wife occurs but once again in a court record, which states that she had paid a wine-tax for her husband.

Ever since 1425 Gutenberg had been engaged in



GUTENBERG'S FIRST PRESS—RESTORED FROM FRAGMENTS FOUND IN GUTENBERG'S WORKSHOP AT MAYENCE.

undertakings of a very mysterious nature—improvements in cutting and polishing stones, and in the making of hand-mirrors with ornamental frames. In 1438 there was an important change in his life, for in that year he entered into a partnership with Andres Dritzehn, the Andres brothers, and Anton Heilmann, which partnership one year later, was dissolved. The contract was discovered in the last century. It contains the germ of the art of printing.

One year after the forming of the partnership, Andres Dritzehn died. His brother Jürgen instituted legal proceedings to ascertain the financial condition of the firm, its method of conducting business, and its purpose. Gutenberg appeared as the leading member of the firm. The court decided for him. The records describe a screw-press with detachable parts; metallic utensils for making letters are also repeatedly mentioned. What occurred in the next four years of Gutenberg's life is not known. In the National Library, at Paris, are specimens of printing from wood blocks, said to have been made by Gutenberg at this period.

It seems reasonably certain that Gutenberg's art was a development of the old process of wood-block print-

AN OLD HAARLEM PRINTING ESTABLISHMENT.

(FROM A SEVENTEENTH CENTURY COPPERPLATE.)

ing, with which the Chinese were long familiar. Specimens of this old method of printing are still preserved, and consist of white letters on a black ground. In the fourteenth century, not only playing cards, but also pictures and texts, were printed from wood blocks in France, Italy and Germany. Long before Gutenberg's time the wood block process had been developed as far as it could be developed. The next step was the invention of movable type.

In many a monastery of the middle ages monks were busily engaged in transcribing and illumining missals and other books. Stamps upon which letters had been carefully carved were used; and many a precious manuscript, the wonderfully uniform writing of which excites astonishment, was probably written with the aid of such stamps. From the cloister this "artificial writing" spread among the laity. As early as the first decade of the fifteenth century, prayers, letters of indulgence, and calendars were partially printed in the manner of the old missals. A scribe who prepared letters of this kind was Prokof Waldvogel, of Bohemia, of whom it is said that, while practising the goldsmith's craft at Avignon in 1444-1446, he had also printed by means of movable type. But the claim that he was the true inventor of printing has been long refuted. Waldvogel never cast type as Gutenberg did.

Gutenberg at first intended merely to reproduce by mechanical means a faithful copy of a manuscript. Of the first attempts to print from movable type nothing is known except that, while at Strassburg, Gutenberg had been uniformly unsuccessful. He seemed to have given up the idea of winning over the rich men of that city; for, in 1448, he returned to Mayence, where he was assisted to a certain extent by a distant relative, Arnold Gelthus. At this time the work to which he had devoted his life must have progressed so far that he could show good specimens of his art. No doubt he had intended first of all to print the Bible; but he had neither the necessary type nor the time and money to produce it for so extensive an undertaking. He was, therefore, compelled to select some book of such size that a very large number of letters was not required. Works of the requisite character were the text books for teaching Latin, which, known as Donati, were extensively used in the schools of the day. The books took their name from their author, Aelius Donatus, whose rules for Latin orthography, syllables, meters and accents, rhetoric, barbarisms, solecisms, and tropes had been taught in every school for a thousand years. So widely were the Donati used that scribes were ever busy in preparing new books to take the place of those torn by long use. Gutenberg conceived the idea of applying his art to the publication of a Donatus. His attempt was successful. Fragments of Donati have come down to us which may well be considered the first specimens of printing from movable type; but which of these fragments is the oldest no one can tell. Probably the two parchment leaves of a Donatus, each with twenty-seven lines, found in Mayence and now preserved in Paris at the National Library, may be regarded as parts of the first impression from Gutenberg's letterpress. The Donatus of which these leaves were once a part was printed probably in 1450. Scholars have devoted no little study to these two precious leaves. It was found that the first nine lines of the fragment were printed from very soft lead type, which was soon worn away; that the next nine lines showed less wear; that the following six lines were printed from new type used for the first time; and, finally, that the last three lines were printed from type made of a better metal. It has been furthermore found that the Parisian Donatus was printed from the same type as the famous 36-line Bible. The inscription "Heydersheim, 1451," written by hand upon one of the leaves, gives some clew to the date of publication. Another fragment, a 30-line Donatus, was printed from the same type as that first mentioned, and has, therefore, a somewhat larger format, from which it is concluded that the fragment was a later product of Gutenberg's press.

Besides inventing movable type, Gutenberg also discovered a method of making an ink which would not run like that used in ordinary writing. He employed an ink made of lamp-black, which is as legible as the day when it was first used.

The type used in the first Donatus was not cast, but cut out of soft metal, each formed with an eye, and strung together like beads, so that all would register. It was not until several years after his first efforts that Gutenberg learned how to cast his type in a matrix.

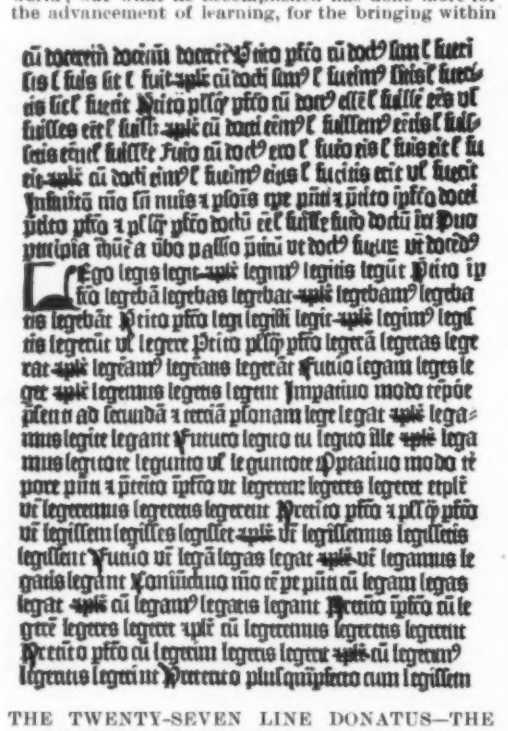
So convincing were these early proofs of Gutenberg's that printing was more than a mere possibility, that he succeeded in persuading Johann Fust, a goldsmith living in Mayence, to advance him the necessary funds to carry on his work. In 1450, therefore, Fust and Gutenberg made a compact, in accordance with the terms of which Gutenberg pledged himself to publish a 42-line Bible, on condition that Fust furnished him with the necessary money. The goldsmith lent the printer originally the sum of 800 gulden at 6 per cent. interest, taking a mortgage on the printing apparatus, which was to become his property if Gutenberg failed to keep his contract. For several years Fust lent money to Gutenberg, until, by 1455, 2,020 gulden had been advanced. Although Gutenberg had completed his task, he found it impossible to pay back the money he had borrowed. Fust resorted to the courts; and in November, 1455, the inventor of printing was declared bankrupt.

The breach in his relations with the inexorable goldsmith was a sore blow for Gutenberg. Not only was he financially ruined; but his presses were lost to him, and a competitor entered the field who was his superior in business sagacity and as well a wealthier man. Johann Fust seized Gutenberg's presses, carried them to his own house, employed Peter Schöffer, a skillful young scribe of Gernsheim, thoroughly versed in the art of printing, and continued the publication of books.

Gutenberg, in the meantime, borrowed more money and established a second press, from which issued various little books, among them a 36-line Bible. The entire apparatus in 1458-1459, probably, passed into the hands of Gutenberg's colleague Albrecht Pfister, who continued to print in Bamberg.

Although his second business undertaking also failed, Gutenberg was not discouraged. Dr. Konrad Humery, of Mayence, author of several theological and legal works, lent him money for a third attempt. The fruit of this new partnership was the publication in 1460 of the "Catholicon" of Giovanni dei Balbi, a Genoese monk. The book was a Latin grammar much used at the time. Popular as the grammar was, Gutenberg could sell no great number of the copies he had printed. Indeed, it is remarkable how little encouragement Gutenberg received. His early books were printed chiefly for the clergy; but the clergy showed no great interest in his work. He was therefore compelled to rely chiefly on the laity for support.

During his connection with Humery a series of events occurred which were of the utmost importance to Gutenberg. For the diocese of Mayence, two churchmen were engaged in a bitter contest in 1462—a contest in which words were bandied and anathemas hurled in writing and in print. At the command of the Pope, Archbishop Count Adolph of Nassau stormed Mayence, then held by Archbishop Diether von Isenburg, who had disobeyed the commands of the Pope. Adolph gave the town over to his soldiers. In the sack that followed, the Fust-Schöffer establishment was burnt and the printers scattered in all directions. The men were all bound by oath never to reveal the secrets of the art; but a process in which many men are employed can not be kept a secret. And thus it was that the art of printing spread throughout Germany. Gutenberg must have been on the best terms of friendship with the new archbishop; for in recognition of his faithful services, he was appointed on January 17, 1465, a "Dhiener und Hofgesind," received annually a new garment, a quantity of corn and wine, and had the privilege of eating at the archbishop's palace at Eltville. An adherent of the archbishop's, no longer troubled with the necessity of earning his daily bread, or providing for that of the morrow, Gutenberg died on February 2, 1468. He had been robbed of the fruits of an invention which has conquered the world; but what he accomplished has done more for the advancement of learning, for the bringing within



THE TWENTY-SEVEN LINE DONATUS—THE FIRST BOOK PRINTED FROM MOVABLE TYPE.

reach of the common people the knowledge formerly attained only by a few, than any other discovery in the history of man.

What has been achieved since Gutenberg's day is well known. At the old press of Mayence, three or four men worked with all their might for three and one-half years to produce 300 copies of a Bible consisting of 637 folio pages. A single pressman with a multiple cylinder press can now print each hour 150,000 copies of a large daily newspaper. That is the subsequent history of printing in the proverbial nutshell.

TRADE SUGGESTIONS FROM UNITED STATES CONSULS.

Swiss Sample Depot for American Goods.—I have received the following letter from Dr. Jurnitschek, the publisher of a Swiss trade journal and president of the Merchant Association of Chur, says James T. DuBois, Consul-General at St. Gall:

"Dear Sir: At a meeting held by the Merchant Association, in Chur, Canton Graubunden, Switzerland, March 26, 1900, I was commissioned to investigate and report upon the question whether or not it would be advisable to establish in Chur (the capital city of the above named canton) a permanent exhibition of samples of all kinds of merchandise from various foreign countries.

"It is needless to dwell upon the great value of such an exhibition. I would, however, mention that in their reports of the last few years, many of the American consuls have frequently and emphatically recommended the exhibition, in foreign countries, of wares and samples of American products, and it would seem very clear that a well-selected assortment displayed here would result in profitable exports to Switzerland and neighboring countries, because it would give a great number of interesting people who visit Chur a chance to become familiar with American firms and their products.

"I will not go into details here concerning this matter: I would, however, say that the main division of the exhibition would be reserved exclusively for wares and samples of various kinds, and that another division would be devoted to catalogues, illustrations of wares, price lists, etc., and one copy of each would also be placed in a reading room attached to the exhibition, for convenient examination by the visitors. Also, it would be our intention to constantly advertise the exhibition in the leading papers of Switzerland, Baden, Wurttemberg, Bavaria, and Austria.

"There can be no question as to the great development of the Canton of Graubunden from now on—the completion of new railroads, the probable cut through the mountain passes, the employment of the great water and mineral resources. The number of tourists passing through our town to mountain resorts is becoming greater every year, and for this reason alone it would seem that a permanent exhibition at Chur would be of great advantage to foreign exhibitors, especially to Americans.

"I write to ask if you would be willing to undertake the necessary steps in your country, which may lead your export merchants to take a favorable interest in this exhibition.

"I am, etc., DR. JURNITSCHEK.
"President of the Merchant Association."

In answer to the foregoing, I informed Dr. Jurnitschek that I believed a permanent exhibition of samples of manufactured articles and agricultural products of the United States would tend to develop American trade in Switzerland, but I was of the opinion that the main establishment should be in Zurich, with branches in other places in the republic, including Chur. Switzerland did a general trade last year amounting to $356,505,453, about $119 for every inhabitant of the republic, or, in the imports alone, about $78 per capita. The United States bought from Switzerland a little over $17,000,000 worth and sold to Switzerland about $14,000,000 worth of goods during 1899, and will probably increase these amounts very considerably this year. Among the American goods which found a market in Switzerland last year may be mentioned: Chemicals and drugs, one third of which was turpentine ($250,000 worth), furniture and wood of different kinds ($300,000), leather and footwear ($670,000), art and scientific work ($45,000), watches and watch material ($242,000), machines and agricultural implements ($500,000), metals of different kinds ($520,000), petroleum and mineral products ($1,400,000), foodstuffs ($7,680,000), raw cotton ($2,560,000), and horses ($110,000).

It will be seen that the principal imports into Switzerland from the United States consisted of raw materials for Swiss industries and foodstuffs. These importations involve no special work on the part of our exporters. What we want now is to get our manufactured articles better appreciated. One way to accomplish this is the establishment of a large sample depot at Zurich, with branches in other towns in Switzerland; but such an undertaking must be intelligently conducted, or it will not prove satisfactory. The right articles must be exhibited and the right persons must be selected to make sales to the small dealers throughout the republic. It took the Swiss people a long time to be convinced, because the American shoe was refined in shape and apparently light of construction, that it would not go to pieces in a month's wear. Now that they have found that they wear quite as well as the best Swiss make, merchants are displaying American shoes in their windows decorated with tiny American flags. The same is true of many of our agricultural implements and hardware. Years were necessary to convince the Swiss farmer that our pitchforks would stand the strain of heavy work, because they are so delicate in appearance. Experience has taught them that quality and not quantity is essential for a good tool, and now on market day one often sees a collection of American pitchforks, iron rakes, hoes, shovels, etc., being sold by some small dealer.

I mention these incidents to show that only by the actual seeing and using of certain manufactured articles can some prejudices be overcome. Catalogue descriptions will not sell our manufactures in Switzerland. Hundreds of things are produced by American industry that are needed in the little republic, and would find a substantial welcome if the consumer could be made to see their merits. This can only be accomplished by patiently and tactfully presenting the advantages of these articles to the Swiss consumer. The United States is too far from Switzerland to send many commercial agents into the Alpine republic. Last year, Germany sent nearly four thousand agents into Switzerland and the United States only one. A central sample depot, intelligently managed, would take the place of the commercial representatives to a great extent, and the expense would be moderate in comparison. I would not, however, recommend the establishment of a sample depot unless the best goods and the best men be used to expand our trade.

Opening for Turbine Wheels in Germany.—Under date of April 27, 1900, Consul Hughes writes from Coburg:

In these times, when coal is hard to obtain, our American turbine wheel houses ought to give special attention to supplying Southern Germany with improved machinery for utilizing the water power which is now running to waste, especially in Thuringia. They should send salesmen who can speak German and know how to operate the machines. The only water wheel known here is the old-fashioned one.

INDEX TO ADVANCE SHEETS OF CONSULAR REPORTS.

No. 758. June 18.—Railways in Brazil.

No. 759. June 19.—Railway in the Azores—Muzzling of Dogs in Germany and Great Britain—German Capital in Central America—Exposition in Senegambia—Advance in Wages at Nottingham—Austrian Demand for Flaxseed.

No. 760. June 20.—*Swiss Sample Depot for American Goods—*New Railway in West Poland—*Venezuelan Duties on Rum, Wheat, and Drugs—*German Tradesmen at the Paris Exposition—A New Substitute for Cacutchouc—*Admission of Goods into China for Exhibition.

No. 761. June 21.—United States Trade in China.

No. 762. June 22.—Export of Deerskins from Foreign Countries.

No. 763. June 23.—Trade in the Danish West Indies—Mining Concessions in Guatemala—German Southwest Africa—Quinine Auction at Batavia—*Electric Power Wanted in Greece—*Canadian Horses for Africa.

The Reports marked with an asterisk (*) will be published in the SCIENTIFIC AMERICAN SUPPLEMENT. Interested parties can obtain the other Reports by application to Bureau of Foreign Commerce, Department of State, Washington, D. C., and we suggest immediate application before the supply is exhausted.

SOME VEHICLES OF ANTIQUITY.

THE first carriages, or the first "chariots," to use the word employed as a generic denomination for the vehicles of antiquity, whether those of state, triumph or simple utility, date from the formation of the first political societies.

Without inquiring whether the invention is to be attributed to Pallas, Telpomene, Trochilus or the Athenian King Erichtonius, whose crooked legs prevented him from going afoot, it is manifest that the use of chariots is very ancient. The first were rude drags, to which were afterward fitted two wheels. The Phrygians subsequently added four, and the Scythians

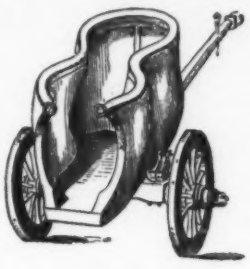


FIG. 1.—ROMAN CURRUS.

raised the number to six, although their carriages were a sort of traveling houses.

The Greek called chariots *αρμα* or *"αρμαξα*, and the Latins "currus" and "carrus," which are generic names. The "currus," which answered to what the French have successively called "char" (cart), "chariot," "carrosse" (coach, carriage) and "caleche" (calash), and to every carriage used for traveling, was divided into several species, which, among the Latins, bore the names of "bigæ," "trigæ" or "quadrigæ," according to the number of horses that were harnessed to them. The "bigæ" were two-horse vehicles, the "trigæ" three-horse and the "quadrigæ" four-horse. There were also chariots with six horses abreast, called "sejuges," or with seven, called "septijuges," or even with ten, called "decemjuges." But it is believed that all such vehicles were used only for circuses or triumphs.

The last mentioned names are rather peculiar to the teams. There were other names that were characteristic of the different forms of carriages—say about twenty, without counting the vehicles designed for the conveyance of merchandise.

The following is a brief description of the best known vehicles of antiquity: In the first place, there was the "currus," properly so called (Fig. 1), a two-wheeled

FIG. 2.—ROMAN CARPENTUM.

chariot or cart, which was entered at the rear, and was closed in front. It was designed to accommodate two persons—the driver and another individual, both standing—and was drawn by two, three, four or more horses. Our figure is taken from a specimen preserved in the Vatican, at Rome. It is made of wood, and covered with plates of bronze.

The "currus triumphalis" was the chariot that carried the Roman general in his triumph. It was not open behind like the ordinary chariot, but was circular and closed all around. Reproductions of it are frequently seen on Roman medals.

The "tensa" or "thensa" was a ceremonial chariot upon which the images of the gods were carried with great pomp in circus performances. The "pilentum" was employed by Roman ladies on fête and gala days, while the "carpentum" (Fig. 2) was in daily use. This latter was provided with two wheels, a hood and curtains that drew aside. It was capable of accommodating two or three persons, and was usually drawn by mules.

The name "cisium" was given to a light carriage—a sort of two-wheeled chaise with accommodations for two persons (Fig. 3). Two leaders were sometimes harnessed to it.

The "carruca" or "carucha," whence the Italian

FIG. 3.—ROMAN CISIUM.

word "carroza," and from the latter the French word "carrosse," was, according to some Latin authors, a very costly ornamented carriage (Fig. 4). Others employ the term "carruca" in a more general sense, and designate the same vehicle by the name of "carruca" and "rheda." This latter (Fig. 5) was provided with several seats, and somewhat resembled our present jaunting car.

The "esseda" or "essedum," like the "rheda," was known to the Gauls before being adopted at Rome. It was a vehicle open in front, but closed behind, and drawn by two horses. It was used in war. The "covinus" also was a war vehicle employed by the Belgians and the ancient Bretons. It was armed with scythes. This same name designates a traveling carriage which was employed by the Romans.

"Benna," a Gaulish word, designates a four-wheeled vehicle made of osier. Finally, the "arcera" resembled a huge box ("arca") through its construction of boards. It was used in Rome as a sort of ambulance for the carriage of invalids or infirm persons.

Historians have left us too eloquent descriptions of triumphal chariots and of chariots that figured in Rome in ceremonies in honor of the gods and emperors to permit us to think that the luxury of carriages was carried to any further extent.

In conclusion, it may be stated that one of the most remarkable of ancient vehicles was the funeral car that carried the body of Alexander from Babylon to Egypt, and a description of which has been left to us by Diodorus Siculus. The dome was of gold covered with slates of precious stones at the summit. The throne and the ornaments placed upon the car were of gold, and the spokes and hubs of the wheels were

FIG. 4.—ROMAN CARRUCA.

gilded. This vehicle, which it took two years to construct, was drawn by sixty-four mules, sixteen abreast, wearing gold crowns and collars of precious stones.

MIRROR MAKING FOR PROCESS WORKERS.*

THERE are many practical men who imagine that the making of mirrors is beyond the skill of the ordinary process operator. They have, perhaps, too, worked in a studio where the mirror took the place of the reversing prism, and where the metallic surface soon became blackened by sulphurous fumes; but in many respects a mirror is far superior to a prism. For one reason, a prism absorbs far more light than a properly silvered mirror. The objection to the mirror, arising from its use in unventilated studios, can be got over in the manner which will be explained later.

The author gives below a practical method of making mirrors which he has had in use for a long time. From these instructions it is the simplest thing to make all kinds of mirrors—plane, convex and concave. The great point to be observed throughout is cleanliness. All glasses, dishes, measures, etc., should have been as scrupulously cleansed as if they themselves were to have been silvered. Three solutions are required, and the process is completed within an hour, while the mirror used in the studio for negative making can be given a fresh silver coating in less than half an hour, since, after treatment with strong acid, it is ready for resilvering. Great attention should be given to the purity of the chemicals. The solutions required are:

10 per cent. nitrate of silver solution.
10 per cent. caustic potash solution.
10 per cent. glucose solution.

All these should be dissolved in distilled water. The nitrate of silver ordinarily used for photographic purposes answers quite well. In regard to the caustic potash, it is in many cases very impure, although a large proportion of the impurity consists of carbonate of potash, formed by absorption of carbonic acid from the air. Even pure caustic potash when dissolved in water and mixed with a little lime water gives a precipitate of carbonate of lime. In order to prevent all difficulties which these impurities may give rise to, the writer advises the use of the purest caustic potash obtainable, as made for analytical purposes. [This can be obtained from large dealers in chemicals. Two pure brands of this potash are sold—one prepared from potassium, the other by precipitation by alcohol.—EDS.] In order to preserve the alkali in the pure state the bottle should be sealed with paraffin wax, and when the substance has been dissolved, a few drops of lime water are added in order to make sure that no carbonate is present.

The third solution is that of glucose. There are a good many varieties of this substance on the market. The only one suitable for the purpose is the fine crystal-

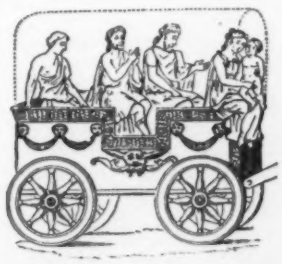


FIG. 5.—GAULO-ROMAN RHEDA.

line product used in analytical chemistry. It is a fine light powder of yellowish tint. The solution of the strength given above is likewise slightly yellowish in color. It should be carefully filtered, and kept in an air-and-light-tight bottle. These preparations having been made, it is matter of only some thirty minutes to obtain a very perfect mirror. The dish and necessary glasses are cleansed and rinsed with distilled water. The glaes plate which is to be silvered is, if of small size, fitted with a handle. A little drop of ordinary sealing wax is melted and allowed to fall in the middle of the plate, and an ordinary match stuck in the melted wax. The handle, thus extemporized, enables the operator to carefully lower the plate into the silvering solution. This little handle is attached to a thin rod by which the plate can be suspended just in contact with the silvering solution. It is only necessary for the plate to dip into this solution by about half of its thickness. It must be borne in mind that the metallic deposit is produced from all parts of the solution, and that any irregularity in the preparation of the plate will give rise to streaks, spots and other defects. The fine silver surface should be formed by the attraction of the glass for the silver which exists in the solution in the nascent state. A too coarse deposit formed by the accumulation of various fine portions is to be avoided.

Plates larger than 4 inches by 3 inches should not be attached to the match as just described. They should be laid on two brass wires which have been varnished with an asphalt varnish; or even two strips of wood, each fitted with a couple of brass screws, can be placed at the ends of the silvering dish. But these arrangements may be left to the ingenuity of the operator.

To compound the silvering solution we take 10 volumes of silver nitrate solution, to which we add enough strong ammonia (drop by drop) until the yellowish-brown precipitate first produced has been dissolved. Then 10 volumes of the caustic potash solution are added, and the dark brown precipitate produced is dissolved as before. Then 25 volumes of distilled water are added, and the mixture filtered into the glass dish. Enough liquid must be prepared to give a depth of liquid of at least 5 millimeters (¼ of an inch). In the second well-cleansed measure 10 volumes of the glucose solution are placed.

The glass plate having been fitted with a handle, is placed in a dish of distilled water, and the strip so arranged that the plate can be just immersed to about half its thickness in the solution. Just before doing this the glucose solution is added. The mixture becomes first yellow, and then, through red and brown, passes to an inky black. Some of the silver is precipitated, and thus discolors the liquid. The metal deposited on the glass surface is a bright white color, while the silver falling to the bottom of the dish is yellowish-gray in color, and collects as a powder. After about fifteen minutes the plate can be removed from the bath and rinsed under the tap. Care must be taken not to stand the wet coated plate on its edges. The slightest pressure would cause some water to find its way between the silver and the glass, and the whole result would be spoiled. The plate is dried in a horizontal position.

The finishing of the mirror depends upon the purpose for which it is to be used. For reversing purposes we want, of course, a mirror without any glass cover. To get this is very easy. A fine smooth wash-leather, which should be used only for this purpose, is rubbed on a well-cleaned plate with a little of the finest rouge. This smooth leather pad is then used to polish the mirror, which is slightly warmed and laid on a piece of clean paper.

However perfect the surface of a mirror may be when it is made, it is soon spoiled by using in an impure atmosphere; but the writer has found that a coating of celluloid varnish (celluloid dissolved in amyl acetate) forms a most excellent protection. It is true, the latter gives a very feeble second image, but the thinness of the coating of varnish is so small that this defect may practically be ignored. To varnish the mirror, it is thoroughly dried and immersed in the solution, being afterward dried at a temperature of 100° Fahr. The glass side of the mirror is then coated with black varnish.

* By H. Van Beek, in The Process Photogram.

NEW TREATMENT FOR THE CRYPTOGAMIC MALADIES OF THE VINE AND OF OTHER PLANTS.

By Dr. RÉPIN.

IN this new treatment of the crytogamic maladies of the vine, cupric sulphate is replaced with the fluorine compounds of zinc, such as zinc fluoride, zinc fluor-silicate and the double fluorides and fluor-silicates of zinc.

The method is identical with the treatment by cupric-sulphate, and according to the trials the results are much more satisfactory.

The zinc fluoride and zinc fluor-silicate, or mixtures of these two salts, are obtained practically in several ways.

1. The treatment of the apatites in the manufacture of the superphosphates disengages large quantities of fluorhydric acid and of fluor-silicic acid which now remain useless. In causing these gases to act in aqueous solution on metallic zinc, or even on calamine or on blende, roasted or brought to the stage of oxide, a mixture can be prepared in varying proportions of zinc fluoride and fluor-silicate quite convenient for the treatment of maladies of the vine.

2. Fluor-spar can also be used directly, of which there are numerous deposits in the south of France, in Italy and in Spain.

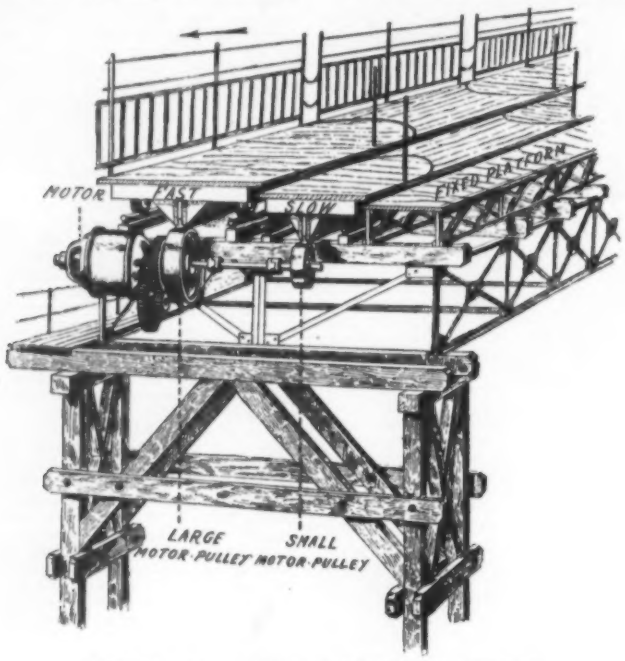
The fluor-spar is decomposed at the temperature of the red by watery vapor into calcium oxide and hydrofluoric acid, which are partially transformed into silicium fluoride, then into fluor-silicic acid, according to the greater or less proportion of the fluorine in the silex.

Another process consists in heating in a retort an intimate mixture of pulverized fluor-spar and of ammonium sulphate, or chlorhydrate. Ammonium fluoride is produced. By causing the ammonium fluoride to act naturally, or in warm solution, on the zinc sulphate or chloride, zinc fluoride is obtained, and the ammoniacal salt is renewed.—La Revue des Produits Chimiques.

Sand for Mortar.—For the preparation of mortar that sand is best adapted which does not consist of pure quartzose sand, but also contains readily decomposable silicates, which can be disintegrated with acid, since the binding of lime and sand is much more intimate and the hardening mortar much firmer, if not only physical but also chemical actions take place. Hence, the quality of a mortar sand would have to be examined on the one hand as to its assailability by caustic lime, on the other hand as to its decomposability by hydrochloric acid and soda.—Zeitschrift für Angewandte Chemie.

THE ROLLING PLATFORM AT THE EXPOSITION OF 1900.

IN order to go from the galleries of the Champ de Mars to the palaces of the Quai d'Orsay quickly and without fatigue, the visitor has the choice of two methods of conveyance—the rolling platform and the electric railway. Both follow the same route and each



MECHANISM OF THE ROLLING PLATFORM.

forms a long, endless belt which circumscribes the space comprised between Avenue de Labourdonnais, the Quai d'Orsay, the Esplanade and Avenue de la Motte-Piquet, for a total length of about 3,400 yards, or about 2·3 miles.

The electric cars run over this route in a direction from right to left, so that in boarding a train at Porte Rapp, for example, a person reaches the Quai d'Orsay, and then the Invalides, and returns to the starting point by way of the Military School. The platform, on the contrary, moves in the opposite direction, and, moreover, is disposed for its entire length at the level of the first story of the exposition galleries of the Champ de Mars and of the Esplanade, with which it directly communicates. The electric railway, which sometimes runs close to the ground, rises and descends, according to circumstances, after the manner of a gravity railway, in order to cross, by viaduct or tunnel, the public roads in its course.

The rolling-platform, which was devised by MM. Blot, Guyenet and De Mocomble, consists essentially of three footpaths, one of which is stationary, while the two others move continuously, one at a speed of 2·6 miles an hour and the other at one of 5·25 miles. The passengers ascend to the platform on the side at which is situated the stationary footpath and pass with the greatest ease from the latter to the low-speed footpath, and thence to the high-speed, where they are free to stand or further to increase their speed by walking thereon in the same direction in which it is moving.

In order to leave the platform, the same operations are performed in a contrary direction. The object of the intermediate footway is, in both cases, merely to assure the preservation of the passengers' equilibrium, which would be jeopardized by too abrupt a passage from a state of rest to a high speed, or conversely. Posts placed at regular intervals further facilitate the passage from one footpath to the other.

The high-speed footpath is 6·5 feet in width, the low-speed one, on which the passengers do not remain, is 3 feet, and the stationary portion of the platform is 3·5.

The movable footpaths consist of a succession of four-wheeled trucks connected with each other by trucks without wheels. The former run upon side rails, while the latter serve to assure the continuity of the system. The extremities of two successive trucks are rounded in a contrary direction, so as to fit into each other and follow the curves of the track.

Motion is communicated to the footpaths in the following manner: Under each truck is fixed a sort of rail or "axial beam," which is jointed at each extremity to the beams of the adjacent trucks. These beams slide over driving-pulleys placed here and there, which transmit the motion received from the electric motors with which they are connected. The variation in speed between the two movable footpaths is obtained very simply by the difference in diameter of their driving-pulleys, which, as may be seen from the accompanying figure of the mechanism of the platform, are mounted upon the same axle.

Some very ingenious arrangements for the regulation of the suspension springs of the wheels, for the easy inspection thereof, and even for the changing of them while the apparatus is in operation, have been elaborated by M. de Mocomble. The entire system is elevated upon a metallic viaduct supported by wooden trestles in order to diminish noise and reduce vibration.

The electric energy necessary for actuating the platform as well as the cars of the railway is furnished by the works that the Compagnie de l'Ouest has established at Moulineaux for the service of the Invalides-Versailles line. The current is received in a special electric station installed on the Champ de Mars (not far from the Quai d'Orsay), where it is transformed and raised to the required voltage, in order to be afterward distributed through conducting cables to the motors of the platform and the "trolley rail" of the railway.

Passengers ascend to the platform by means of stairways and, at certain places, by traveling ramps, while direct communication with the first story of the palaces is obtained by means of footbridges and passages. These approaches are established at points that are called "stations," though perhaps improperly so, since, as the movable footpaths have a continuous motion imparted to them, they do not admit of stoppages; and, moreover, passengers can get on or off the platform at any part of the route. These "stations," which are formed by a simple widening of the stationary footpath and are covered with a glass roof, are eleven in number, viz.: Rue Saint-Dominique, Rue de l'Université, Pont des Invalides, Palais de la Perse, Puissances Étrangères, Palais de l'Hygiène, Pont de l'Alma, Palais des Armées de Terre et de Mer, Tour Eiffel, Porte Rapp and Palais de l'Agriculture.

The fare is half a franc (10 cents) for any distance less than that embraced in the round trip, which consumes twenty minutes.

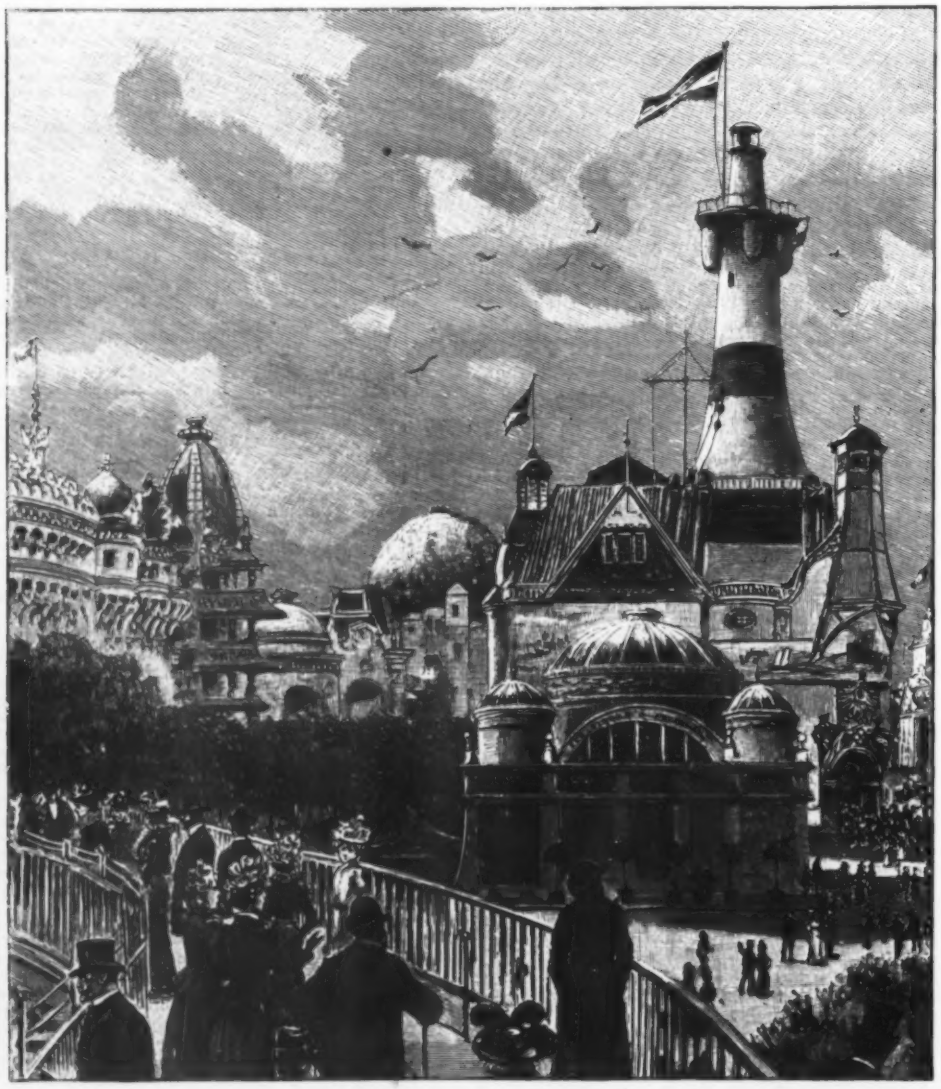
The peculiar feature of the electric railway is the application of a system of transmission of electric energy by means of a third rail placed externally to the two rails that constitute the track. This is, as it were, a "trolley rail," which transmits the current to the cars through the medium of pivoted contact-slides. The service employs trains made up of three cars with a capacity of about two hundred persons; and running at intervals of two minutes. The forward car of each train is an automobile, and is provided with four 35 horse power motors, which permit it to make a round trip in 12 minutes, inclusive of stoppages.

The cars are of the open style, like those used in large cities in the summer; but the precaution has been taken to close them tightly on the trolley-rail side, so as to prevent any accident due to the imprudence of the passengers, who are therefore obliged to get on and off on the opposite side. There are five stations along the line, viz.: Palais de Électricité, Tour Eiffel, Guerre et Marine, Puissances Étrangères and Invalides. The fare is a quarter of a franc (5 cents) for anything less than a round trip.

In conclusion, we must have a few words to say concerning the movable ramps, which permit the visitors to avoid the fatigue of climbing stairs in order to reach the different stories of the palaces. These ramps are of various forms, ten of the Peat type being located at the Champ de Mars and seven at the Invalides. What renders such apparatus very interesting in places where there is a large crowd is the fact that their capacity is much greater than that of elevators or even of ordinary stairways. With a ramp of the type under consideration, the ascensional speed is slightly less than one foot per second. It takes from 30 to 35 seconds to ascend to a height of about twenty feet. Since the ramp is capable of accommodating from 30 to 35 persons at a time, its total carying capacity is from 3,000 to 4,000 passengers per hour, while an elevator of ordinary dimensions is capable of carrying but from 300 to 400 persons in the same space of time.

As regards mechanism, the ramp consists simply of a very thick, strong and taut endless leather belt supported by a large number of rollers at the part designed for the passage of the public. Two other endless belts form side guards, which are also movable. In other systems, the leather belt is superseded by a movable platform of jointed flat rods.

One of our engravings shows a portion of the movable platform, with a view of the German Pavilion of Commercial Navigation in the background. The pavilion reflects the utmost credit upon the enterprise and good taste of those who contributed toward its creation. It owes some of its best exhibits to the use of electricity, including a huge globe revolved by electric motor. As it spins around, the globe shows the routes of the German ocean steamship companies. There is also a fine model of the North German Lloyd office at Bremen, surmounted by a high tower equipped with a Marconi wireless telegraph system. The object of the service in actual practice is to enable the



PORTION OF THE MOVABLE PLATFORM, WITH A VIEW OF THE GERMAN PAVILION OF COMMERCIAL NAVIGATION IN THE BACKGROUND.

managers of the company to get into communication with their steamers the moment they come within etheric hailing distance or until they get beyond that point.

THE TRANS-SAHARA RAILWAY.

IN the partition of Africa, France has acquired an enormous district, which differs from the British and German spheres of influence in being much more compact. It stretches from the Mediterranean on the north to the Congo River on the south, from the Egyptian Soudan on the east to the Atlantic on the west, and with the exception of Morocco and the British and German possessions on the Gulf of Guinea, almost all the territory included within these wide limits is under the dominion of France.

On the northern edge of this area are Algiers and Tunis, on the western and southern Senegal, French Guinea, the Ivory Coast, Dahomey and French Congo, while the interior of this vast region is divided into two parts; the Sahara to the south of Algiers, and the Soudan, between the Sahara and the equator.

It was long believed that the Sahara was a frightful desert, void of all animal and vegetable life, and that, on the contrary, the Soudan was a marvelous country, of unexampled fertility; but the reports of travelers who have visited these regions have given us juster ideas concerning them.

The Sahara, it is true, has arid regions, bare plateaus and sandy mountains, but it also contains many cultivated and inhabited oases, where the date palm flourishes, and it is reasonably certain that with the aid of artesian wells these fertile areas can be largely increased.

The reports about the Soudan are less concordant. It is known that districts about the upper Niger and the upper Senegal are rather poor, while the central Soudan between the Niger and Lake Tchad is a fertile country, but there is very little information about the regions bordering Lake Tchad on the north and east.

The war in South Africa, and the recent occupation by the French of In-Salah, a place in the Sahara south of Algiers, have, according to M. G. Leugny, who writes in La Revue Technique, aroused fresh interest in a project which of late years has been rather neglected —the Trans-Sahara railroad.

As far back as 1880, some preliminary surveys to the south of Algiers were made by exploring parties, but the disastrous end of the expedition commanded by Colonel Flatters, which was ambushed and nearly exterminated by the Tuaregs, put a stop to this work for many years. But now there is renewed interest in the matter, and a Paris newspaper, the Matin, is sending out an expedition to complete the work of Flatters.

The southern portions of the French African empire are practically isolated at present, the vast interior regions presenting an almost insurmountable barrier between them and Algiers, so that in case of a war with a strong naval power like England, they would be in great danger. But Algiers is comparatively near France and possesses, moreover, its own means of defense, so that if it and the other parts of French Africa could be firmly knit together by a railroad there would be little to fear from an outside foe.

Besides these strategic reasons in favor of a Trans-Sahara railroad, there are political and economic ones as well. Such a road would bring the different parts of the country into touch with one another and would greatly facilitate their economic conquest.

Algiers possesses a railway system, some of whose branches already touch the confines of the Sahara, and the question now to be decided is: From what point shall the new road take its departure? Biskra, already connected with Philippeville on the Mediterranean by a line through Constantine, seems to be the place most favored. From here the road would run almost due south to Timassinin and Amguid, about 1,100 kilometers from Philippeville, and on the watershed between the Mediterranean and the Niger. At Amguid the road would divide, the main line going east of south toward Lake Tchad, and a branch running southwest to Bouroum, at the bend of the Niger. As to the watershed there seem to be but few engineering difficulties. For long stretches there is a grade of only one-tenth of one per cent., and the divide can be crossed at an altitude of 650 meters.

There is but little positive information about the southern slope toward the Niger and Lake Tchad, but for the present most attention will be paid to the northern section of the road as far as Timassinin and Amguid, which are important markets and caravan stations. It is estimated that this section could be completed in two years.

As to the amount of traffic that can be counted on, it is pointed out that the inhabitants of the Sahara get their supplies from Tripoli. Now the cost of transporting a ton of merchandise on camel's back from the latter city to In-Salah, in the Touat region, is from 1,300 to 1,400 francs, and the journey takes from forty-five to fifty days. If the railroad were built, Timassinin could be reached from Philippeville in three or four days, and a ton of freight could be transported for about 60 francs. Freight for In-Salah would have to be forwarded by camel from Timassinin at a total cost of 550 francs by this route, against 1,300 francs for the all-camel line. This difference would necessarily make Timassinin a great center of trade in the Sahara, and, as the road is extended southward, it will tap other caravan routes and build up a large import and export business, the total receipts being estimated at 6,265,000 francs per annum.

When the road reaches the Soudan, it will make an outlet for the rich products of that region, some of which are ivory, ostrich feathers, gold dust, hides and leather, india rubber, coffee, cocoa, pepper, palm oil, and precious woods.

The length of the main line from Biskra to Lake Tchad will be about 3,100 kilometers, and it is estimated that receipts amounting to 10,000 francs per kilometer (£620 or $3,100 per mile) can be counted upon from the total freight and passenger traffic of the Sahara and the Soudan, while it is claimed that the fixed charges and operating expenses will be only 2,500 francs per kilometer—$775 per mile.—Engineering Magazine.

The Sultan of Turkey is so pleased with an automobile which he bought of a German concern, that he conferred a decoration upon the manager of the factory.

AGRICULTURAL BUILDING AND PROPYLÆA AT THE PAN-AMERICAN EXPOSITION.

A HANDSOME STRUCTURE DEVOTED TO THE INTERESTS OF THE FARM AND PLANTATION.

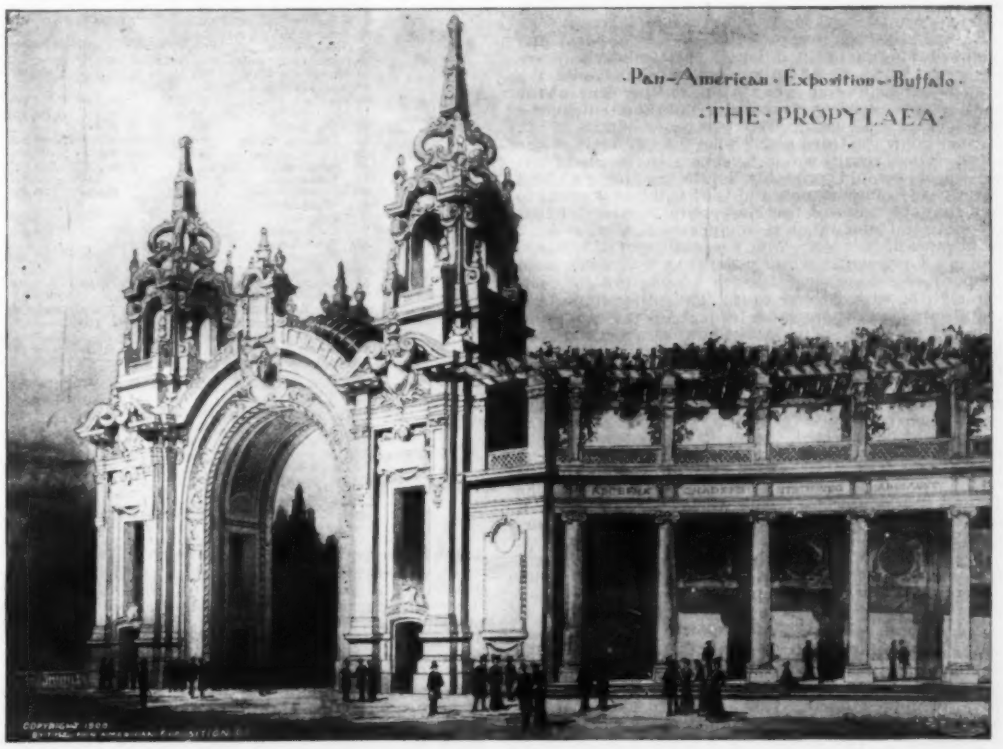
THE agricultural industry will have a fitting setting at the Pan-American Exposition at Buffalo during the summer of 1901. A commodious and richly proportioned building will be devoted exclusively to the interests of the farm. So wonderful has been the development of agriculture, and so marvelously has the productivity of soils been increased by the application of scientific methods, it is no exaggeration to say that, potentially, the cultivated acreage of the world has been doubled within a few years. Science has indeed made two blades of grass to grow where but one grew before. More than that, it has, by irrigation, made the desert to blossom as the rose.

THE PAN-AMERICAN EXPOSITION—THE AGRICULTURAL BUILDING.

The Agricultural Building will stand opposite the Manufactures and Liberal Arts Building on the north side of the Mall, its longest façades looking to the north and south. On the east will be the Live Stock Exhibit, to which about ten acres are devoted. Northward will be the Stadium, covering another ten acres. On the west is the Grand Court with the Electric Tower, 348 feet high, and the Electricity Building just beyond. There are four broad entrances to the building. Opposite the northern entrance is an artistic bridge crossing the Grand Canal. Vaulted loggias connect the east and west entrances with the main entrance on the south, and from these elevated promenades people may view the throng of sightseers upon the Mall. The low tiled roof overhangs the walls eight feet, making a deep shadow over the richly decorated cornice. The east and west entrances are treated with lattice work to imitate an arbor. The lattice is fastened to the dome, ceiling and walls, then, on a background of blue, grapevines produce the effect of looking through to the open air. The southern entrance, which is 30 feet wide, is flanked on both sides by large groups of statuary. Above the doors, and following the lines of the arch, panels will be painted to represent the signs of the zodiac. On either side of the vestibule are large niches, affording places of rest and retreat from the crowds. On either side of the south entrance, at the intersection of the eaves of the loggia, are large consoles surmounted by figures representing the "Sower" and "Reaper." The Agricultural Building is 150 by 500 feet, and contains exposition space to the amount of about 75,000 square feet.

The Propylæa of the Pan-American Exposition at Buffalo, in 1901, will mark the northern boundary of the Plaza and the extreme northern limit of the Grand Court. This elaborate and beautiful architectural ornament will serve the purpose of a colossal screen, shutting out from the Exposition the noisy and smoky reminders of the toil and care of our every day life. The Propylæa is a magnificent creation treated with fine artistic skill. The combined work is 500 feet long, consisting of two massive arched entrances, or gateways, at the extreme eastern and western ends of a long, gracefully curved colonnade. These gateways are 36 feet wide and 54 feet high. Two open towers surmount the sides of each arch, and above the twenty tall Ionic columns that form the colonnade is a pergola, or arbor, over which growing vines will wind their delicate tracery of green. Behind the colonnade will be the railway station, reached by a broad promenade. In the spaces between the great columns statues will be placed, showing their outlines distinctly against the background of color.

The electric street railway cars, as well as the steam roads, will unload many of their passengers at the station opposite the Propylæa, which is reached from the tracks by a spacious subway. The visitor will thus enter the grounds through the high arches on either hand of the Propylæa, and obtain at once one of the grand views of the great group of Exposition buildings. On the right and left of the Propylæa are the Midway and the Stadium, in front the Electric Tower and sunken gardens and Court of the Fountains; the Electricity Building and the Agricultural Hall are on either side; further along, the Machinery and Transportation Building and that of Manufactures and Liberal Arts; and in the distance the Temple of Music and the Ethnology Building. The visitor thus plunges at once into the midst of the Exposition.



PAN-AMERICAN EXPOSITION—THE PROPYLÆA.

THE DIAMOND FIELDS OF RUSSIA.

THE existence of diamonds on the western slopes of the Ural Mountains is now well established.

At the commencement of this century Humboldt suggested the possibility and the probability of this discovery.

The first stone was found in 1829, and from 1830 to 1835 nearly fifty were discovered, one of considerable size, and the other from one-fourth to three-fourths of a carat.

The search continued from 1830 to 1874, and diamonds were frequently found. But the operations were conducted at little expense and were not thorough.

These stones were found in the territory of Perm, on the borders of the Poludenka, a small affluent of the Kama. Like California, the district had already been exploited for gold and platina.

The central mine is known under the designation of the Adolph Gulch Mine. It presents no special geological characteristics. At the bottom of the valley is an excavation of fossil calcareous stones proceeding from the destruction of dolomitic layers. Above is a bed of ferruginous clay, which contains many crystals of quartz, a stratum composed of the debris of calcareous rocks and specular iron, and finally, about a meter

below the surface, a layer of deep red, magnetic sand. Some diamonds are also found in Russian Lapland along the river Paatsjoki: the rocky bed is of gneiss.

The river sand also contains garnets, zircons and tourmalines, but in limited quantities, not sufficient to justify regular exploration.

The study and the relations of these northern lands from a geological view-point have been published with circumstantial details by Prof. Derby in his report on the glacial and neighboring regions.—Translated from Le Diamant.

UNITED STATES MINERAL AND METAL PRODUCTION.

THE collection of statistics for "The Mineral Industry," volume viii., is now completed, and that volume will be in the hands of purchasers at an early date. According to our usual custom, we give herewith the tables showing the total production of minerals and metals in the United States for the year 1899, comparing the statement with the corresponding one for the previous year. We may note here that in the preparation of the statistics for this volume, the figures previously reported for 1898 have been revised in the light of later and more minute investigation, in accordance with the usual practice.

The total value at the place of production of the mineral and metal output of the United States in 1899 was $1,211,361,861, as against $861,751,017 in 1898. These amounts are quite unexampled in the history of the mineral industry. Of this vast sum, ores and minerals contributed $580,836,032 in 1899 and $440,997,150 in 1898; metals, $496,057,320 in 1899 and $312,650,587 in 1898; secondary products, $63,996,969 in 1899 and $49,095,010 in 1898; while the value of metals smelted or refined from foreign material was $70,471,540 in 1899 and $59,008,000 in 1898. In these gross totals of value are included certain duplications, such as those of the manganese and iron ore used in making ferromanganese and pig iron; bauxite used in making aluminium and alum; coal used in making coke; lead used in making white and red lead and litharge and a few other duplications, the whole amounting in 1899 to $92,581,031, and in 1898 to $62,232,984. The values of the crude ores or metals smelted or refined here should also be deducted in order to arrive at the net value of the mineral industry of the United States. Deducting the duplications noted above, we find that the total value of the mineral products reported by our mines and reduction works in 1899 was $1,118,780,830, while in 1898 it was $799,518,033; showing an increase last year of no less than $319,262,797, or 39·9 per cent. A part of this gain was due to the large increase in quantities, but a part also to the very general appreciation in values of the minerals and metals included in our output.

In compiling these tables great use has been made of the reports of several State geological surveys, especially those of Alabama, Kansas, Iowa and Montana, and the State mining bureaus of California and Colorado. For the iron and steel industry the very complete figures collected by the American Iron and Steel Association have been used. In great part, however, the figures have been compiled from returns made directly by producers, whose general readiness to aid in the work has done very much toward assuring its completeness.

Taking the leading products of our mineral and metal production in the order of their relative importance and value, we find that coal and coke hold the first place, their value constituting 35·4 per cent. of the total; while pig iron is second, its value—including ferro-manganese—being 20·9 per cent. of the total. Copper holds the third place, with 8·3 per cent. of the total. These results would be generally expected; but most people would probably expect to find gold and silver next in importance, and they will be surprised to find that the value of the clay products exceeded that of gold, and amounted to 6·1 per cent. of the total. Gold came fifth in order, its proportion of the whole being 5·8 per cent.; while petroleum was sixth, with 5·3 per cent., stone seventh, with 3·5 per cent., and silver eighth, with 2·8 per cent. The other important metals are lead, whose value formed 1·6 per cent., and zinc, 1·2 per cent. The latter, however, was exceeded in value by cement, which furnished 1·3 per cent. of the total. No other single product except iron ore, the value of which is duplicated in pig iron, formed as much as 1 per cent. of the entire production, though natural gas reached it very nearly, 0·96 per cent.

As might be expected, the most marked gains, both in quantities and values, were shown by fuel and by the materials of construction; though there were also large advances in gold and in other substances. The United States now leads the world as a producer of coal, iron and copper, and in many of the less important metals and minerals.

We give below some condensed notes on the several metals and minerals in 1899. The production of gold, silver and coal was fully commented on in our issue of June 3d.

METALS AND ALLOYS.

Aluminium.—Production of aluminium in the United States in 1899 was 6,500,000 pounds ($2,112,000) against 5,200,000 pounds ($1,690,000) in 1898. The increased price of copper during 1899 caused an increased consumption of aluminium wire for electrical conductors.

Antimony.—The production of metallic antimony in 1899 was 2,500,000 pounds ($241,250) against 2,000,000 pounds ($165,000) in 1898.

Copper.—The production increased from 535,900,232 pounds ($63,129,047) to 581,319,091 pounds ($100,916,994). The main increase was in Arizona. Montana showed a slight increase, while Lake Superior fell off somewhat.

Ferromanganese.—The production of ferromanganese, including spiegeleisen, was 219,768 long tons ($18,350,628) against 213,769 long tons ($10,474,681) in 1898.

Ferromolybdenum.—The production in 1899 was 6,000 pounds ($3,000) against 2,100 pounds ($1,050) in 1898.

Gold and Silver.—The domestic production of gold in 1899 was 3,391,196 troy ounces ($70,096,021) against 3,148,642 troy ounces ($65,082,430) in 1898. The production of silver was 57,126,834 troy ounces ($34,036,168) against 56,755,032 troy ounces ($33,065,482). Besides the production reported, 1,423,349 ounces of gold and 40,542,858 ounces of silver were smelted in the United States from imported ores. The average value of silver in the United States in 1899 was 59·58 cents per ounce against 58·26 cents per ounce in 1898.

Iron.—The production of pig iron in 1899, exclusive of ferromanganese and spiegeleisen, was 13,400,735 long tons ($234,725,754) against 11,560,165 long tons ($110,168,733) in 1898. Of the production in 1899, 8,202,778 long tons were Bessemer pig against 7,337,384 long tons in 1898. Basic pig increased from 785,444 to 985,035 long tons. The remainder of the output is classed as foundry and forge iron.

Lead.—The domestic production in 1899 was 217,085 short tons ($19,407,399) against 228,475 short tons ($17,272,710) in 1898. The greater portion of the falling off was due to suspension of operations in Idaho owing to labor difficulties. The average price of lead at New York was 4·47 cents, against 3·78 cents per pound in 1898. Besides the above, the American smelters in 1899 recovered 76,423 tons of lead from foreign ore and base bullion, against 89,209 tons in 1898.

Molybdenum.—Some 30,000 pounds of molybdenum ($37,500) were produced in 1899, against 9,550 pounds ($11,937) in 1898. A considerable portion of the ore came from Arizona.

Nickel.—The domestic production of nickel was 22,500 pounds ($8,156) against 11,145 pounds ($3,845) in 1898.

Platinum.—There was no production of platinum in 1899 against 300 troy ounces ($3,837) in 1898. The value of bar platinum at New York varied from $15 to $18 per ounce against an average of $12.79 in 1898.

PRODUCTION OF ORES AND MINERALS IN THE UNITED STATES. (FIRST PRODUCTS.)

Number.	Products.	Customary Measures.	1898. Quantity. Customary Measures.	1898. Quantity. Metric Tons.	1898. Value at Place of Production. a Totals.	1898. Value at Place of Production. a Per M. Ton.	1899. Quantity. Customary Measures.	1899. Quantity. Metric Tons.	1899. Value at Place of Production. a Totals.	1899. Value at Place of Production. a Per M. Ton.
					$	$			$	$
1	Asbestos	Sh. T.	895	806	13,425	16·72	912	827	13,800	16·76
2	Asphaltum	Sh. T.	25,600	23,306	482,175	20·69	15,060	13,662	308,130	22·55
3	Asphaltic limestone	Sh. T.	14,000	12,701	70,495	5·51	10,378	9,415	54,422	5·78
4	Bitumin's sandstone	Sh. T.	49,536	44,966	146,378	3 26	42,104	40,646	123,229	3·03
5	Barytes	Sh. T.	28,347	25,626	112,988	4·41	32,636	29,607	137,071	4·63
6	Bauxite	L. T.	26,791	27,220	66,978	2·46	36,813	37,402	101,235	2·71
7	Borate of calcium. c	Sh. T.	15,335	13,911	306,700	n22·05	24,068	21,834	505,428	n23·15
8	Bromine	Lb.	486,978	221	136,354	617·19	433,003	196	125,571	640·67
9	Cement, nat. hydraul. g	Bbls	8,161,078	1,110,592	3,819,905	3·44	10,186,447	1,386,163	5,183,500	3·74
10	Cement, Portland	hBbls	3,584,586	650,383	6,168,106	9·48	5,805,620	1,053,365	10,441,431	9·91
11	Chrome ore	L. T.	100	102	1,000	9·84	100	102	1,000	9·84
12	Clay products				50,379,874				74,064,628	
13	Coal, anthracite	Sh. T.	52,848,605	47,943,940	81,445,937	1·70	60,577,398	54,955,455	108,648,780	1·80
14	Coal, bituminous	Sh. T.	165,435,389	150,082,000	129,089,154	0·86	191,501,350	173,728,895	172,406,679	0·99
15	Coal, cannel	Sh. T.	49,889	45,259	134,700	2·98	36,639	33,239	91,597	2·76
16	Cobalt oxide	Lb.	9,640	k 4,373	15,494	k 3·53	10,300	k 4,672	15,810	k 3·42
17	Copper sulphate. f	Lb.	55,119,361	25,002	m1,879,570	75·18	67,908,370	30,801	m 3,590,975	114·64
18	Corundum	Sh. T.	796	713	63,630	89·24	970	880	78,570	89·26
19	Emery	Sh. T.	2,956	2,682	143,940	53·62	3,000	2,722	150,000	55·11
20	Feldspar	L. T.	21,350	21,690	107,147	4·94	26,968	27,390	137,866	5·03
21	Fluorspar	Sh. T.	12,145	11,018	86,985	7·89	24,090	21,800	152,655	7·00
22	Fullers earth	Sh. T.	15,553	14,110	87,365	6·19	13,620	12,356	81,900	6·63
23	Garnet	Sh. T.	2,892	2,615	82,990	31·71	2,565	2,327	72,672	31·23
24	Grahamite	Sh. T.	2,675	2,427	80,250	n33·07	3,150	2,858	97,650	n34·17
25	Graphite, crystalline	Lb.	1,647,679	k 747,389	82,385	k 0·11	3,632,608	k 1,647,740	145,304	k 0·09
26	Graphite, amorphous	Sh. T.	1,200	1,089	11,400	10·47	1,030	934	8,240	8·82
27	Gypsum	Sh. T.	314,865	285,644	864,415	3·03	372,285	337,735	1,109,986	3·28
28	Iron ore	L. T.	20,655,805	20,986,359	37,593,674	1·79	25,341,000	25,746,456	38,284,300	2·95
29	Lepidolite	Sh. T.	5	5	181	36·20	124	112	4,600	41·07
30	Magnesite. c	Sh. T.	2,355	2,136	9,420	4·41	2,000	1,814	7,600	4·19
31	Manganese ore. i	L. T.	187,782	190,787	416,027	2·18	143,256	145,548	306,478	2·10
32	Mica, scrap	Sh. T.	3,529	3,201	o 39,937	12·44	6,917	6,275	o 50,956	8·12
33	Mica, sheet	Lb.	110,918	k 50,317	92,232	k 1·83	97,586	k 44,265	76,926	k 1·74
34	Molybdenite	Sh. T.	8	7	400	57·14	18	16	900	56·25
35	Monazite	Lb.	150,000	68	7,500	110·25	330,000	150	18,480	123·20
36	Natural gas				e10,500,000				e11,500,000	
37	Ocher. p	Sh. T.	41,950	38,057	461,450	n12·13	42,386	38,562	465,146	n12·13
38	Petroleum, crude	gBbls	55,499,875	7,764,713	44,542,906	5·74	57,334,304	8,007,398	64,143,899	8·01
39	Phosphate rock	L. T.	1,357,645	1,277,767	4,355,025	3·41	1,823,391	1,852,565	7,031,785	3·80
40	Precious stones				e125,000				e 175,000	
41	Pyrites	L. T.	191,160	194,219	589,329	3·03	178,408	181,262	583,323	3·22
42	Salt. q	Bbls	18,756,394	2,382,197	4,753,664	2·00	19,861,948	2,522,610	5,437,941	2·16
43	Silica, brick	M.	33,449	....	500,254		45,000		850,000	
44	Diatom. earth	Sh. T.	1,392	1,262	11,002	8·71	1,186	1,031	8,216	7·27
45	Flint	Sh. T.	20,593	18,682	47,383	2·53	24,305	22,049	56,481	2·56
46	Sand, etc	L. T.	e 800,000	812,800	e1,178,560	1·45	e 850,000	863,600	e1,228,580	1·55
47	Pumice	Sh. T.	144	131	720	n 5·51	340	308	1,700	n 5·52
48	Grindstones	Sh. T.	38,859	35,253	488,675	13·44	43,959	39,879	591,965	13·59
49	Whetstones				107,906				115,220	
50	Tripoli	Sh. T.	1,865	1,692	3,357	1·99	2,102	1,907	4,729	2·48
51	Slate, roofing	Sq'es.	1,041,632	314,688	2,777,996	j 2·67	1,008,374	332,146	3,055,988	j 2·78
52	Manufactures				538,856				540,434	
53	Pigment	Sh. T.	7,880	7,154	70,671	9·88	4,911	4,455	52,398	11·30
54	Soapstone	Sh. T.	18,802	17,111	158,635	9·27	20,011	18,153	189,504	10·44
55	Soda, natural. r	Sh. T.	7,150	6,486	94,650	14·59	10,500	9,526	152,250	15·98
56	Stone, for building				e35,404,900				e38,797,487	
57	Stone, limestone (flux)	L. T.	5,275,819	5,360,292	2,304,900	0·43	6,707,485	6,814,754	3,475,525	0·51
58	Stone, lithographic	Sh. T.	112	102	2,240	n 21·96	40	36	2,000	55·56
59	Strontium sulphate	Sh. T.	3	3	10	n 3·35	*Nil.*	*Nil.*	*Nil.*	*Nil.*
60	Sulphur	L. T.	2,736	2,779	59,754	m21·57	1,553	1,590	33,585	m21·12
61	Sulphuric acid. f. l	Sh. T.	47,558	43,144	970,183	m22·49	50,572	54,043	1,228,456	m24·59
62	Talc, common	Sh. T.	9,112	8,266	78,645	9 51	6,671	6,052	51,763	8·55
63	Talc, fibrous	Sh. T.	54,807	49,721	285,750	5·75	57,130	51,819	272,595	5·26
64	Tungsten ore	L. T.	78'807	80·13	17,398	217·19	168	171	n 33,000	196·49
65	Uranium ore	Sh. T.	33	30	16,500	550·00	43	39	21,500	551·28
66	Wulfenite	Sh. T.	12	11	144	13·00	(b)	(b)	(b)	(b)
67	Zinc sulphate	Sh. T.	145	132	4,640	35·15	528	479	21,648	n 45·19
68	Zinc ore, exported	Sh. T.	11,782	10,688	299,870	28·06	28,220	25,601	725,944	28·36
69	Zinc white. s	Sh. T.	32,747	29,708	2 226,796	74·96	39,663	35,988	3,331,692	92·04
70	Est. prod. unspecified				5,000,000				5,000,000	
	Totals				440,997,150				580,836,032	

Quicksilver.—The production of quicksilver decreased to 28,879 flasks ($1,155,160) from 30,493 flasks ($1,109,945) in 1898. The increased price of quicksilver has caused the reopening of many old California mines, and it is probable that 1900 will show a marked increase in production.

Tungsten.—In all, 45,000 pounds ($54,000) were produced in 1899 against 33,200 pounds ($43,160) in 1898.

Zinc.—The production in 1899 was 129,675 short tons ($14,912,625) against 114,104 short tons ($10,429,106) in 1898. Missouri and Kansas increased their production, while the avarage price of spelter in New York in 1899 increased to 5·75 cents, against 4·57 cents per pound in 1898.

ORES, MINERALS AND CHEMICAL PRODUCTS.

Alum and Aluminium Sulphate.—The production of crystallized alum in the United States in 1899 was 27,276 short tons ($845,556) against 18,791 ($563,730) in 1898. The production of aluminium sulphate in 1899 was 81,805 short tons ($2,106,479) against 56,665 ($1,416,675) in 1898.

Ammonium Sulphate.—Statistics for the amount of ammonium sulphate recovered by coke works in 1899 are not available at the time of publication, but the production in 1898 was 3,589 short tons. A larger amount of this substance is obtained from the ammoniacal liquor of illuminating gas works, but there are no statistics as to that production. The value of sulphate, basis 25 per cent., was $58.76 per short ton at New York in 1899, against $50 in 1898.

Asbestos.—The domestic production was 912 short tons ($13,869) in 1899, against 895 short tons ($13,425) in 1898. In each year the production was made almost entirely by one mine in Georgia.

Asphaltum and Asphaltum Products.—The production of asphaltum, liquid and solid, in 1899 was 15,060 short tons ($308,130), against 25,600 ($482,175) in 1898, the entire output each year having been made in California. California and Kentucky, chiefly the former, produced 42,104 short tons ($123,229) of bituminous rock in 1899, against 49,536 ($146,275) in 1898. Utah and the Indian Territory produced 10,378 short tons ($54,422) of asphaltic limestone, against 14,099 ($70,495) in 1898. The output of Utah increased in 1899 and that of the Indian Territory decreased somewhat. The production of grahamite or gilsonite in 1899 was 3,150 short tons, against 2,675 in 1898, the production in 1899 being valued nominally at $31 (in 1898 at $30) per ton at the mines. Colorado produced 150 tons in 1899, the remainder being derived from Utah.

Barytes.—The production in 1899 was 32,636 short tons ($137,071) against 26,791 short tons ($112,988) in 1898. Of the output in 1899, Missouri furnished 17,836 tons, the remainder being obtained in Virginia, North Carolina and Tennessee.

Bauxite.—The production in 1899 was 36,813 long tons ($101,235) against 26,791 ($66,978) in 1897. Of the production in 1899, Georgia furnished 19,619 tons, the remainder being mined in Alabama.

Borate of Calcium.—The production in 1899 was 24,068 short tons, against 15,335 in 1898. Most of this product is colemanite, mined in California.

Bromine.—The production in 1899 was 433,003 pounds ($125,571), against 486,978 ($136,354) in 1898. Of the production in 1899, liquid bromine constituted 307,003 pounds, against 356,978 in 1898, the remainder of the output being the bromine equivalent of potassium bromide produced in Michigan.

Carborundum.—The production reported by the sole producer was 1,741,245 pounds ($156,712) in 1899, against 1,504,152 pounds ($151,444) in 1898. The decline in value was due to the increased proportion of the cheaper grades marketed.

Cement.—The total production of Portland cement in 1899 was 5,805,620 barrels of 400 pounds, valued at $10,441,431, against 3,584,586 ($6,168,106) in 1898. The Lehigh District of Pennsylvania and New Jersey has maintained its supremacy as a center of production, and Michigan, Ohio and other States also showed important gains. There was remarkable prosperity in this industry on account of the increased demand and higher prices. The production of natural rock cement in 1899 was 10,186,447 barrels of 300 pounds, valued at $5,183,500, against 8,161,078 ($3,819,995) in 1898. The increase in the production of natural rock cement was due chiefly to the Indiana-Kentucky district, where the remarkably low prices brought about by excessive competition among the producers undoubtedly stimulated consumption. Other parts of the United States showed an increase, owing to the large amount of construction work in 1899. The production of slag cement in 1899 was 244,751 barrels of 400 pounds, valued at $360,800, against 157,662 ($235,721) in 1898.

Chrome Ore.—The production in 1899 was 100 long

tons ($1,000), an amount the same as in the previous year. Chrome mining in California ceased in 1898 and the entire output was derived from Pennsylvania and Maryland.

Clay.—The value of brick and other clay products made in the United States in 1899 was $74,064,628, against $59,379,874 in the previous year.

Coal and Coke.—The total production of coal in the United States in 1899 was 252,115,387 short tons ($276,147,056) against 218,333,833 ($210,619,791) in 1898. The production of anthracite, all of it from Pennsylvania with the exception of an insignificant amount from Colorado, was 60,577,398 short tons ($103,648,780) in 1899, against 52,848,605 ($81,445,937) in 1898. Kentucky produced 36,639 short tons ($91,597) of cannel coal against 49,889 ($134,700) in 1898. The remainder of the output each year was bituminous coal. The total production of coke in 1899 was 18,025,256 short tons ($42,081,002) against 15,938,556 ($31,109,680) in 1898.

Cobalt Oxide.—The production of cobalt oxide in 1899 was 10,200 pounds against 9,640 in 1898. The value was $1.55 per pound in 1899, against $1.60 in 1898.

Copperas.—The production in 1899 was 13,770 short tons ($108,508) against 11,285 ($58,105) in 1898. The entire make each year being supplied by the Pittsburg Crushed Steel Company.

Feldspar.—The production in 1899 was 26,968 long tons ($137,866), against 21,350 ($107,147) in 1898, Pennsylvania being the chief producer each year.

Fluorspar.—The production in 1899 was 24,030 short tons ($152,655), against 12,145 ($86,985) in 1898, Illinois and Kentucky furnishing the entire output.

Fuller's Earth.—The output in 1899 was 13,620 short tons ($81,900), against 15,553 ($87,365) in 1898. The most part each year was mined in the vicinity of Quiney, Fla.

Garnet.—The production in 1899 was 2,565 short tons ($72,673), against 2,882 ($82,930) in 1898, the output each year being furnished by New York, Pennsylvania and Connecticut. The domestic resources of this mineral are large, but the demand for it is limited.

Graphite.—The production of crystalline graphite in 1899 was 3,632,608 pounds ($145,304), against 1,647,679 ($82,385) in 1898. The proportionately large increase in value was due to the increased demand for crucibles for the manufacture of projectiles during the Spanish war. The larger part of the product in 1899 was obtained from Ticonderoga, N. Y., but a considerable quantity was mined in Pennsylvania, where some of the old mines were reopened. The production of amorphous graphite in 1899 was 1,030 tons ($8,240), against 1,200 tons ($11,400) in the previous year. One company produced 405,870 pounds ($32,475) of artificial graphite, against 185,647 ($11,603) in 1898.

Gypsum.—The production increased from 314,865 short tons in 1898 to 372,285 in 1899. These figures represent the amount of crude rock quarried. The greater part of the production is marketed as stucco or plaster of Paris.

Iron Ore.—The production in 1899 was 25,341,000 long tons, against 20,655,865 in 1898, these figures being exclusive of the production of manganiferous iron ore, reported separately under manganese. The increase in production was due chiefly to the Lake Superior ranges.

Lead White, Red Lead and Litharge.—The production of white lead in 1899 was 103,466 short tons ($10,812,197), against 93,173 ($9,391,738); of red lead 10,199 ($1,070,895), against 9,160 ($916,000); of litharge 10,020 ($103,206), against 7,460 ($710,192); of orange mineral 928 ($139,200), against 653 ($88,937) in 1898. The most of these products are obtained by the corrosion of pig lead; but a small part of the white lead product is made directly from ores.

Limestone for Iron Flux.—Iron smelters consumed 6,707,435 long tons in 1899 against 5,275,819 in 1898, the increase being caused by the greater make of pig iron.

Lithographic Stone.—Utah produced 40 short tons in 1899, against 112 in 1898. There was no output in previous years.

Magnesite.—California produced 2,000 short tons ($7,600) in 1899 against 2,355 ($9,420) in the previous year.

Manganese Ore.—The production of manganese ore, including manganiferous iron ore, was 143,256 long tons in 1899 against 187,782 in 1898. Included in these figures are 53,762 tons of manganiferous iron ore from Michigan and Wisconsin in 1899, against 112,318 in 1898, and 53,921 tons of franklinite residuum from New Jersey in 1899, against 47,470 in 1898.

Mica.—The production of sheet mica in 1899 was 97,586 pounds ($76,926) against 110,918 ($92,232) in 1898. The production of scrap mica was 6,917 short tons ($50,956) against 3,529 ($39,837), the value of scrap mica being reckoned for the product before grinding. Practically the entire production of mica is made in South Dakota, New Hampshire and North Carolina.

Mineral Wool.—The production in 1899 was 7,448 short tons ($85,899) against 6,560 ($70,314) in 1898. A part of this product was made from slag and a part by the fusion of natural rock, the latter being the more valuable.

Molybdenite.—This mineral was produced in the United States in 1899 to the amount of 18 short tons, valued nominally at $50 per ton, against 8 short tons of the same value per ton in 1898.

Monazite.—North Carolina produced 330,000 pounds ($18,480) in 1899 against 150,000 ($7,500) in 1898. Notwithstanding the increase, no important future is to be looked for in this industry, on account of the vast supplies of cheaper mineral available in Brazil.

Ocher and Oxide of Iron Pigments.—The production of ocher, umber, sienna, and natural oxide of iron ground pigment, the last being known commonly as "metallic paint," was 42,286 short tons ($465,146) in 1899 against 41,950 ($461,450) in 1898. The values are reckoned nominally at $11 per ton each year. These products merge into one another so that no satisfactory division of the statistics is possible. Pennsylvania is the largest producer.

Petroleum.—The total output in 1899 was 57,234,304 barrels ($64,143,890) against 55,499,876 ($44,542,906) in 1898. The increase was due to the Appalachian and the Lima fields. California and Texas made increased outputs, while Colorado and Kansas showed a decrease. The above values are calculated for crude oil at the wells. The average was considerably higher in 1899 than in the previous year.

Phosphate Rock.—The production in 1899 was 1,823,391 long tons ($7,031,785) against 1,257,645 ($4,355,025) in 1898. The increase was due especially to Tennessee and the deposits of Florida and South Carolina. Phosphate mining was generally prosperous in 1899 on account of the higher prices.

Salt.—The domestic output of salt increased from 18,756,394 barrels in 1898 to 19,861,948 in 1899, Kansas and New York each contributing largely to the increase.

Silica.—The production of vein and dike quartz in 1899 was 24,305 short tons ($56,481) against 20,593 ($47,333) in 1898. This material was used chiefly in pottery, for packing acid towers, and for grinding for various purposes. The production of grindstones, which are made out of quartzite, or a very hard sandstone, amounted to 43,959 short tons ($501,985) in 1899 against 38,859 ($438,675) in 1898. These were produced entirely in Ohio and Michigan. The production of oilstones, scythestones and whetstones in 1899 was valued at $115,220 against $107,990 in 1898. Utah produced 340 short tons of pumice stone, valued nominally at $1,700, against 144 ($720) in 1898. There was a production of 2,102 short tons of tripoli, valued at $4,729, against 1,865 ($3,367) in 1898, most of this product being obtained in Missouri. The production of diatomaceous earth in the United States in 1899 was 1,136 short tons ($8,216) against 1,392 ($11,002) in the previous year.

Slate.—The production of roofing slate in 1899 was 1,098,374 squares ($3,055,988) against 1,041,632 ($2,777,996) in 1898. The production of slate manufactures, chiefly blackboards and structural material, was valued at $540,434 in 1899, against $528,856 in 1898. The production of slate pigment, including Baraga graphite and various kinds of mineral black, was 4,911 short tons, against 7,886 in the previous year, the values of the products after grinding being respectively $50,338 and $70,671.

Soda.—The production of soda and soda products from salt, reduced to a common basis of 58 per cent. soda ash, was 387,020 metric tons in 1899, against 340,632 in 1898. The average value of 58 per cent. ash at the works was $15.31 per metric ton in 1899 against $11.98 in 1898. California and Nevada produced 10,500 short tons ($152,250) of natural soda, basis 58 per cent., in 1899, against 7,150 short tons ($94,650) in 1898.

Strontium Sulphate.—There was no production of strontium sulphate in 1899, against 2 tons produced in Ohio in 1898 for experimental purposes.

Sulphur and Pyrites.—Louisiana, Nevada and Utah produced 1,565 long tons of sulphur in 1899 against 2,726 in 1898. The average price of Sicilian seconds at New York was $21.46 per ton, against $21.92 in the previous year. The domestic production of pyrites in 1899 was 178,408 long tons, worth on an average $3.27 per ton, against 191,160, averaging $3.08 per ton, in 1898. Virginia was the largest producer each year, Massachusetts ranking second. Sulphuric acid was recovered as a by-product in roasting blende and pyrites, chiefly the former, to the extent of 59,572 short tons against 47,558 in 1898, the figures being reduced to a common basis of 66° B. Concentrated acid of the latter strength averaged $22 25 per 2,000 pounds at New York in 1899 against $21.40 in 1898.

Talc and Soapstone.—The production of soapstone for slabs and other manufactured articles in 1899 was 20,011 short tons ($189,504) against 18,862 ($158,635) in 1898. The increase in value was due to general conditions of prosperity. The production of common talc, mostly ground to powder, was 6,671 short tons ($51,763), against 9,112 ($78,645) in 1898. This was produced chiefly in North Carolina, Pennsylvania and Vermont. The production of fibrous talc, all of it from St. Lawrence County, N. Y., was 57,120 short tons ($272,595), against 54,807 ($285,759) in 1898.

PRODUCTION OF METALS IN THE UNITED STATES.

Number.	Products.	Customary Measures.	1898. Quantity. Customary Measures.	1898. Quantity. Metric Tons.	1898. Value at Place of Production. a. Totals.	1898. Value at Place of Production. a. Per M. Ton.	1899. Quantity. Customary Measures.	1899. Quantity. Metric Tons.	1899. Value at Place of Production. a. Totals.	1899. Value at Place of Production. a. Per M. Ton.
					$	$			$	$
71	Aluminum	Lb.	5,200,000	[2]2,358,705	m1,690,000	40·72	6,500,000	[2]2,948,381	m2,112,500	40·72
72	Antimony	Lb.	2,000,000	907	165,000	181·92	2,500,000	1,137	341,250	212·18
73	Copper	Lb.	535,900,232	243,083	f63,129,047	259·70	581,319,091	263,685	100,916,994	f382·72
74	Ferromang'nese. s	L. T.	213,769	217,189	v10,474,681	48·23	219,768	223,284	v18,350,628	82·19
75	Ferromolybden'm	Lb.	2,100	.....	1,050	1,102·30	6,000	2·7	3,000	1,102·30
76	Gold	Oz. w.	3,148,642	k97,933	65,082,430	k664·60	3,391,196	k105,471	70,096,021	k664·60
77	Iron, pig	L. T.	11,560,165	11,745,128	v110,168,372	9·38	13,400,735	13,615,350	v284,725,754	17·24
78	Iridium	Oz. w.	8·5	.....	255	.....	5·6	.....	165	.....
79	Lead	Sh. T.	228,475	207,271	m17,272,710	83·33	217,085	196,938	m19,407,330	98·55
80	Molybdenum	Lb.	9,550	4,332	11,937	k2·76	30,000	k13,608	37,500	k2·76
81	Nickel	Lb.	11,145	k5,055·3	m3,845	k0·76	22,500	k10,205·9	m8,156	k0·80
82	Platinum	Oz. w.	300	k9·3	3,837	k411·25	*Nil.*	*Nil.*	*Nil.*	*Nil.*
83	Quicksilver x	Fl'sks	30,493	1,058	1,109,945	1,049·09	28,879	993	1,155,160	1,163·30
84	Silver	Oz.	56,75[illegible],082	1,765,265	33,005,482	m18·73	57,126,834	1,776,829	34,636,168	m19·16
85	Tungsten	Lb.	33,200	k15,059	43,160	k2·87	c45,000	k20,412	n54,000	k2·87
86	Zinc	Sh. T.	114,104	103,514	10,429,106	m100·75	129,673	117,644	14,912,625	m126·76
	Totals				312,650,857				496,057,320	

SECONDARY MINERAL AND CHEMICAL PRODUCTS OF THE UNITED STATES.

Number.	Products.	Customary Measures.	1898. Quantity. Custom'ry Measures.	1898. Quantity. Metric Tons.	1898. Value at Place of Production. a. Totals.	1898. Value at Place of Production. a. Per M. Ton.	1899. Quantity. Customary Measures.	1899. Quantity. Metric Tons.	1899. Value at Place of Production. a. Totals.	1899. Value at Place of Production. a. Per M. Ton.
					$	$			$	$
87	Alum	Sh. T.	18,791	17,047	563,730	m33·07	27,276	24,745	845,556	m34·17
88	Aluminum sulphate	Sh. T.	56,663	51,404	1,416,575	m27·56	81,805	74,213	2,106,479	m28·38
89	Ammonium sulphate	Sh. T.	3,589	3,256	179,450	m55·11	(b)	(b)	(b)	(b)
90	Carborundum	Lb.	1,504,152	723	151,444	209·47	1,741,245	790	156,712	198·37
91	Cement, slag	bBbls	157,662	98,606	235,721	8·24	244,755	44,408	360,800	8·10
92	Coke	Sh. T.	15,938,556	14,459,363	31,109,680	2·15	18,025,256	16,352,405	42,081,002	2·57
93	Copperas	Sh. T.	11,285	10,238	58,105	5·68	13,770	12,492	108,508	8·69
94	Crushed steel	Sh. T.	390	299	46,300	154·52	337	306	47,350	154·41
95	Graphite, artificial	Lb.	185,647	84,200	11,603	40·14	405,870	184,410	32,475	40·18
96	Lead, white. z	Sh. T.	93,172	84,525	9,391,738	111·11	103,466	93,864	10,812,197	115·20
97	Lead, red	Sh. T.	9,160	8,310	916,000	110·23	10,199	9,252	1,070,895	115·67
98	Lead, orange miner'l	Sh. T.	653	592	88,937	150·23	928	842	139,200	165·32
99	Litharge	Sh. T.	7,460	6,768	710,192	104·93	10,020	9,090	103,206	113·53
100	Mineral wool	Sh. T.	6,560	5,951	70,314	11·82	7,448	6,757	85,899	12·72
101	Soda, manufact'ed. r	M. T.	.....	340,022	4,080,651	11·96	.....	387,020	5,925,276	15·31
102	Venetian red	Sh. T.	3,270	2,967	64,570	21·76	6,575	5,965	121,519	20·37
	Totals				49,095,010				63,996,969	

METALS PRODUCED FROM FOREIGN ORES AND BULLION. (*aa*)

Metals.	Customary Measures.	1898. Quantities. Customary Measures.	1898. Quantities. Kg.	1898. Values.	1899. Quantities. Customary Measures.	1899. Quantities. Kg.	1899. Values.
				$			$
Copper	Pounds	36,055,352	16,354,600	4,247,330	40,659,868	18,443,195	7,068,583
Gold	Troy oz.	1,065,552	33,142	22,024,960	1,421,439	44,274	29,422,691
Lead	Short tons	89,209	80,969,874	6,744,200	76,423	69,330,491	6,832,216
Nickel	Pounds	7,127,784	3,233,142	2,459,085	8,048,343	3,650,708	2,917,525
Silver	Troy oz.	40,392,095	1,256,321	23,532,435	40,542,858	1,261,014	24,240,575
Total values				79,008,000			70,471,540
Total ores and minerals				$440,997,150			$580,826,032
Total metals				312,650,857			496,057,320
Total secondary products				49,095,010			63,996,909
Grand total, values				$861,751,017			$1,211,361,861

In using the statistics in the foregoing tables reference should also be made to the detailed tables under the respective captions further on in this volume, where many explanatory notes as to the statistics will be found. The following notes refer to the four preceding tables: (*a*) Except where otherwise specified. (*b*) Not enumerated. (*c*) Amount or value of crude mineral. (*d*) Partly estimated. (*e*) Estimated. (*f*) Amount recovered as a by-product. (*g*) Barrels of 300 lb. (*h*) Barrels of 400 lb. (*i*) Includes manganiferous iron ore; this is not duplicated in the report of iron ore. (*j*) Value per square, i.e., 100 sq. ft., lapped and laid; the weights are calculated on the basis 3 squares = 2,000 lb., but these figures are only approximately correct. (*k*) Kilograms or per kilogram. (*l*) Reduced to a basis of 66° B. (*m*) Average market price at New York. (*n*) Nominal. (*o*) Value before grinding. (*p*) Includes ocher, umber, sienna, and oxide of iron. (*q*) Includes salt used for the manufacture of alkali; the barrel of salt weighs 280 lb. (*r*) Reduced to a basis of 58% ash. (*s*) Includes a small amount made from spelter. (*t*) Average value of Lake copper at New York, less 0·25c. per lb. (*u*) Includes spiegeleisen, though the total value is reckoned as if the whole product were ferromanganese. (*v*) Average market price at Pittsburg. (*w*) Troy oz. (*x*) Flasks of 76·5 lb. (*y*) Barrels of 42 gal. (*z*) Includes a comparatively small amount made directly from ores. (*aa*) Not included in the preceding tables.

Abbreviations: Sh. T., short tons (2,000 lb.); L. T., long tons (2,240 lb.); M. T., metric tons (2,204·6 lb).

chief producer in this country is the American Steel and Wire Company, which controls all the wire and rod mills recovering copperas as a by-product. The above statistics do not include copperas converted into Venetian and Indian reds at the works of original production.

Copper Sulphate.—The production in 1899 was 67,903,370 pounds, against 55,119,361 in 1898. Of this the amount recovered as a by-product, chiefly by gold and silver refiners, was 37,285,870 pounds in 1899 and 28,061,501 in 1898. The remainder of the output each year was made from metallic copper previously reported in the production of that metal. The average value of copper sulphate at New York per 100 pounds was $5.20 in 1899, against $3.41 in 1898.

Corundum and Emery.—The production of corundum in 1899, all of it from North Carolina and Georgia, was 970 short tons ($78,570), against 786 ($63,630) in 1898. The production of emery, most of it from Massachusetts, was 3,000 short tons ($150,000), against 2,956 ($143,800) in 1898. The resources of the United States in both corundum and emery of the highest quality are large, and an increasing production is to be looked for. The production of steel emery or crushed steel in 1899 was 674,000 pounds ($47,250), against 660,000 ($46,200)

Tungsten Ore.—There was a production in 1899 of 168 long tons of tungsten ore from South Dakota, Colorado, Arizona and New Mexico, with a small amount from Connecticut, which was valued nominally at $33,600 at the mines. The statistics for 1898 were approximately 79 long tons, valued at $17,398.

Uranium Ore.—Colorado produced 43 short tons, valued at $551.28 per ton, in 1899, against 33 short tons, valued at $500 per ton, in 1898.

Venetian Red.—The production of Venetian and Indian reds in 1899 was 6,575 short tons ($121,519) against 3,270 ($64,570) in 1898. These figures include only the output at works where the original copperas was made, and do not include any that may have been made by second hands.

Wolfenite.—Arizona shipped 12 short tons of this mineral, valued at $12 per ton, in 1898. There was no output reported in 1899.

Zinc Ore.—The amount of zinc ore of domestic origin exported from the United States in 1899 was 28,220 short tons ($725,944), against 11,782 ($290,870) in the previous year. Most of the ore exported was mined in New Jersey.

Zinc Sulphate.—There was a production in 1899, by one concern, of 528 short tons, against 145 in 1898.

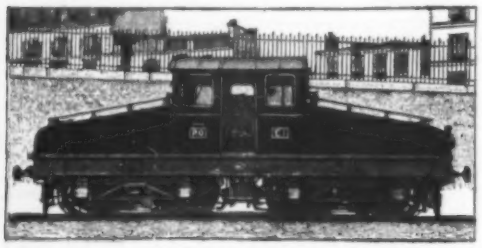
Zinc White.—The production in 1899 was 39,663 short tons, against 32,747 in 1898. The total value was $3,331,692, against $3,226,796 in 1898. Nearly all the American production of zinc white is made directly from ores, most of it from ores mined in New Jersey.—The Engineering and Mining Journal.

THE ELECTRIC LOCOMOTIVE OF THE COMPAGNIE D'ORLEANS.

THE prolongation of the Orleans line in Paris, between the Quai d'Austerlitz station and the new station of the Quai d'Orsay (old Cour des Comptes), has been partially opened to exploitation since May 28.

Until a new order of things occurs, the service will be limited to four or five suburban trains and one trunk-line train in each direction. It is a preliminary trial rather than a true opening, which cannot take place until after the completion of the terminal station, along about the first of July.

Upon this two and one-half mile prolongation, which we have already described in all its details, traction is, as well known, to be effected electrically. The accompanying figure, from L'Illustration, represents the type of locomotive adopted to this effect. It is an engine analogous to those in use at Hoboken, N. J., and at Baltimore, Md. It is mounted upon four driving axles, each actuated by a dynamo arranged as in street railway motors. The electric current that supplies these



ELECTRIC LOCOMOTIVE OF THE COMPAGNIE D'ORLEANS.

dynamos is generated and distributed in the following manner: At the Ivry station, not far from Tolbiac bridge, there has been constructed a special electric works, which produces the current necessary, not only for the propulsion of the trains on the prolongation, but also for the lighting of the stations and the maneuvering of the pumps, elevators, windlasses, etc.

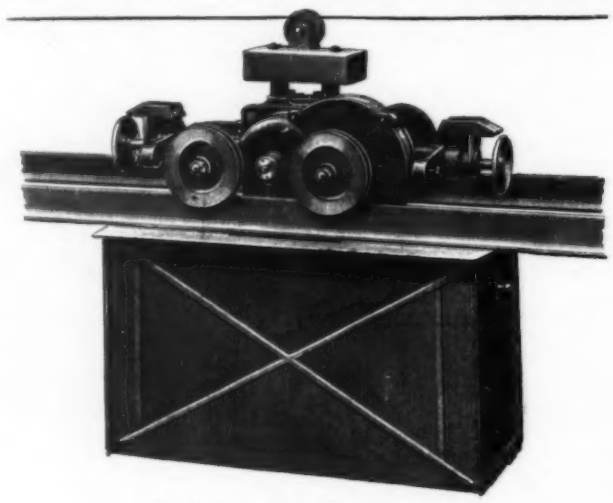
The high tension current is reduced and transformed in two electric substations, one established at Quai d'Orsay and the other at Quai d'Austerlitz. It is afterward distributed along the tracks by a trolley rail, which runs externally to the track, but changes sides at the traversing of switches in order to avoid the crossing of rails; and at the entrance to the station of Quai d'Orsay, it is even suspended from the upper part of the tunnel. This explains why the locomotive is provided with three sliding collectors in front and two overhead trolleys behind.

The electric locomotives are eight in number. Each weighs about from forty-five to forty-six tons, and is easily capable of hauling two hundred and fifty ton passenger trains between the Austerlitz and Quai d'Orsay stations in seven minutes, such trains being the heaviest now run. After the line is completely open, these engines will have to assure the service of one hundred and fifty trains a day. All these latter will therefore have to change locomotives at the Austerlitz station, with the exception of the palace car ones, which will not stop at the old station, but will run upon the prolongation with their ordinary engines. It will be possible to effect the change of locomotives in two minutes.

INDOOR TRACTION.

WE publish herewith an engraving illustrating one application of electric traction for indoor purposes. The device, a little trolley carrier, has been introduced during the past year by the firm of C. & E. Fein, and the particular apparatus from which the engraving was reproduced is one of three which are in operation in the building of the Allgemeiner deutscher Versicherungsverein in Stuttgart, accomplishing in the quietest and most satisfactory manner work which formerly kept three employes constantly on their feet.

The track on which the little carriage runs consists of two rails of ordinary angle-iron, which may rest on consoles secured to the wall of the building, or they may be carried by pillars, which, of course, must be so arranged as to allow the carriage to pass freely. Each of the three lines in the establishment above referred to consists of a single track on which runs one carriage with its box or carrier, the only stations being those at the ends of the lines; but other stations can be provided if desired. The frame of the carrier is journaled on the axles of the cast iron wheels that run on the rails, the deep grooves in the wheels fitting over the rails. The axle at the right of the cut serves as the driving axle, for it carries a spur wheel which is engaged by a rawhide pinion on the armature shaft of the little $\frac{1}{10}$ horse power motor; which, with the entire apparatus for transmitting motion, is contained in a closed casing. In the apparatus shown, the wheels and rails are utilized as return conductors, but where this is not advisable, two parallel conductors are used, in which case a second trolley similar to the one described



INDOOR ELECTRIC CARRIER.

is employed, provision for which is made on the carriage. At each end of the carriage is a spring-pressed buffer, which, when the car reaches the end of the line, comes in contact with a similar buffer secured to the wall of the building. Each of the buffers on the carriage is provided with a wedge-shaped piece in which a catch is formed. This wedge raises a spring-pressed latch-hook located at the end of the track, which then falls into the catch, thus holding the car stationary. The box or carrier, which hangs below the track, may be made of wood, plates of hard rubber, or of sheet iron or zinc, as desired, and its form and size depend on the use for which it is intended. In the plant above referred to, the boxes are of iron and are provided with a door at each end. Inside the box, in the middle of the top, is a switch for regulating the direction of the movement of the carriage. The latter runs over the track at a speed of from 3 to 5 feet per second, which is reduced at the end of the line by the application of a mechanical brake and the cutting off of the current at the proper moment. The conductors terminate at a certain, determined distance from the station, so that the carriage is carried over the last stretch of track solely by its own momentum, which is considerably decreased by the upward inclination of the track at the end of the line, whereby the shock of the blow when the buffers strike together is lessened. The hook then falls into the catch on the end of the carriage, which is thereby held stationary and can be unloaded. After the box has been reloaded the switch is turned, the latch lifted, and as the carriage receives sufficient impulse from the pressure of the buffers to start it, it runs down the inclined end of the track until it reaches the end of the conductor, from which point it is carried over the course by the electricity.

This carrier will be found most useful in large buildings where books, papers or materials of any kind are to be carried constantly from one place to another.

For our engraving and the above data we are indebted to Uhland's Wochenschrift.

Port of Cucuta Closed.—Consul Shaw sends from Barranquilla, May 12, 1900, copy of a dispatch from the civil and military chief of the province, to the effect that the government of Colombia has declared the port of Cucuta closed.

INSCRIBING AND REPRODUCING DIAPHRAGM FOR PHONOGRAPHS.

THE ordinary diaphragms employed for reproducing and repeating sounds in phonographs and other apparatus of the kind have the disadvantage of distorting the voice, and of mingling their own vibrations with those that are produced. So, the voice reproduced is no longer a natural one, but a sort of caricature thereof.

M. Z. Burguet, an attaché of the laboratory of experimental phonetics of the College of France, has recently devised for scientific researches a new diaphragm, which has already been used in the industries and met with great favor on account of the new properties that it possesses.

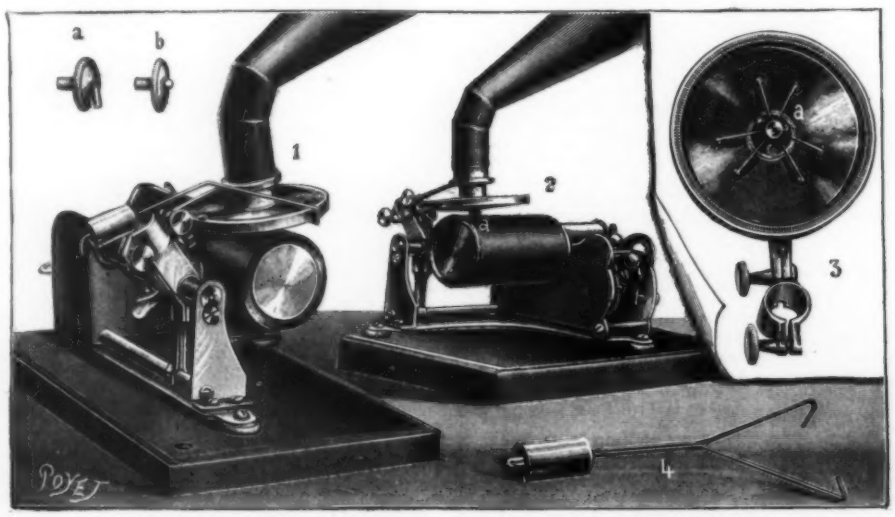
This diaphragm is formed of a sheet of mica mounted in a metallic box, as shown in No. 3 of the accompanying figure. Upon different points of this sheet are fixed communicating radii, *a*, which converge toward an external central point, *F*. At this point are screwed the styles, *a*, for reproduction, and *b* for inscription.

Such an arrangement improves the results obtained, since it is thus rendered impossible for the mica plate to mingle its own vibrations with those of the sound transmitted to it. This result has been reached by means of a system of tightening by means of a screw, the mounting of which is fixed at right angles with the box containing the diaphragm. For reproduction, this screw must be tightened, but for inscription it must be allowed a certain amount of liberty. The arrangement is further relieved by means of a counterpoise, which, as may be seen from No. 4 of the figure, consists of a cylindrical weight placed at the extremity of two rods provided with hooks. The hooks are placed in such a way as to engage with the diaphragm at the point opposite the supporting arm, upon which the weight rests. Particular arrangements have been provided for the adapting of this support to any phonograph whatever.

The diaphragm (No. 3) is provided with a lug and a bolt that permit of mounting it upon an external ring to which it may be fixed by means of a screw. No. 2 of the figure shows the adaptation of the diaphragm to the support, and the latter to a phonograph, for reproduction.

In No. 1, on the contrary, the screw is seen loosened from the diaphragm, and the counterpoise adjusted for inscription.

This new inscribing and reproducing diaphragm is



BURGUET'S INSCRIBING AND REPRODUCING DIAPHRAGM.

1. Method of fixing the diaphragm upon a phonograph for inscription. 2. Method of fixing for reproduction. 3. Mounting of the diaphragm upon a support. 4. Counterpoise.

distinguished from other apparatus of the kind, in that it emits no nasal or grating sound with the rollers that it has registered. Such defects disappear in great part even when any rollers whatever are employed.—La Nature.

It is reported at Damascus that a library has been discovered which escaped annihilation when Tamerlane destroyed the town in 1401.

A PORTABLE FILTERING FOUNTAIN.

WE have already described a large number of filters, and, among them, the Grandjean-Eden apparatus and a fountain operating under pressure, devised by the same inventors. A new application of the Grandjean-Eden filter has just been made to a small portable fountain that may prove very useful under many circumstances, and especially at the season of the year when people resort to the country.

Fig. 1 gives a general view of this fountain, the capacity of which may vary from 2 to 35 quarts, according to the style of the apparatus. It consists of a cylindrical vessel, at the upper part of which, on the left hand side, is situated a metallic case in which is placed an ordinary Grandjean filter, and which communicates with an external cock, *R*. This case is provided with a vertical tube, *B*, which descends to the bottom of the vessel. It is through this tube that passes the water to be filtered. A special aperture, with a conduit, *C*, is arranged at the upper part of the fountain and

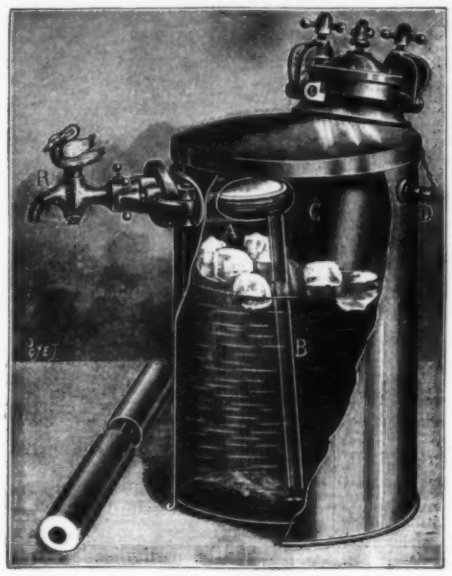


FIG. 1.—PORTABLE FILTERING FOUNTAIN.

serves as a water level and a mouth through which to introduce water and ice. Upon the side, at *D*, there is an aperture which is provided with a valve and to which is fixed a bicycle pump for putting under pressure the whole of the water contained in the vessel.

After the filter case and the cock have been adjusted, the fountain is filled with water up to the level of the tube, *C*, and then the ice is introduced. After this it is only necessary to open the cock, *R*, in order to obtain a flow of filtered water entirely freed from microbes. It will be seen from this that it is possible to obtain sterilized water in a few instants. This is an advantage that will be highly appreciated, especially by travelers in districts where good drinking water is not always to be found. M. Grandjean, the inventor, has devised some new arrangements of his filter that are deserving of being made known. In Fig. 3 is represented a portable filtering apparatus. A small force and suction pump is here set in motion through a simple lever arranged as shown in the engraving. It suffices to insert the suction pipe seen at the lower part into any receptacle containing water to be filtered, and then to maneuver the lever in order immediately to obtain a bottleful of sterilized liquid. The pump used in this apparatus weighs but 3½ pounds and may be easily placed in a case. It permits of sucking water from a depth of from 15 to 20 feet, and of obtaining a quart of water in three minutes.

This apparatus, which is styled the "Colonial pump," is designed especially to permit travelers in the colonies to utilize, after a rapid filtration, any bad water that they may chance to meet with.

Finally, we may mention an application of the Grandjean-Eden filter that has been made by the Algerian Railway Company of the East upon its lines. In each of its stations it has installed a filter supplied by a rotary pump arranged as shown in Fig. 3. It suffices to give a hand wheel a few revolutions in order to obtain at once an abundant supply of cool filtered water,

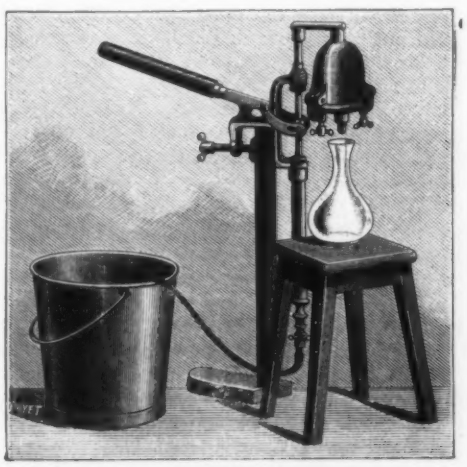


FIG. 2.—PORTABLE FILTERING PUMP.

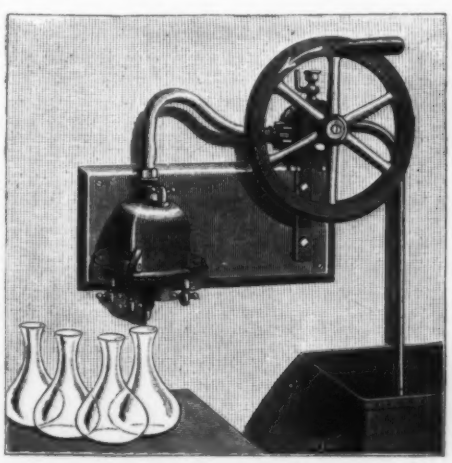


FIG. 3.—ANOTHER STYLE OF PORTABLE FILTERING PUMP.

which makes its exit from a reservoir, and which has not been exposed to heat for some hours in a tank.

For the above particulars and the illustrations we are indebted to La Nature.

A NEW TYPEWRITER ALPHABET.

By JACOB BACKES.

WHILE delegates from all parts of the civilized world are attending the five-hundredth anniversary of the birth of the hero printer, Gutenberg, there are influences at work which will result in a gradual detechnicalization of print-typing, enabling any educated person to make his or her own columns, pages, indexes, price lists, etc., with appropriate ruling if any is required to be done, in block form, with the typewriter, camera, and process, according to the user's original ideas, and without recourse to typesetting or linotyping. The typewriting machines and the various duplicating devices are already forerunners of such achievements in a new typographical era; and the literary man of the future will no more imagine it necessary to go out of his own sitting room, library, or "sanctum" to have a page or column made print-ready than he now thinks it necessary to resort to special talent to have a private note written in his diary.

As a rule, the introduction of a new style of type has little direct significance to anyone except the printer; recently, however, a typewriter type called the American Alphabet has been devised, in behalf of the general introduction of which some unusual claims are made. This type is not patented or monopolized in any way, and in buying any of the standard writing machines, it can be obtained without extra charge. The cost of special characters for machines already bought and in use averages about 75 cents each.

The difference between typewriter "Roman" and the genuine printers' Roman is most noticeable in the apparently uneven distribution of letters in lines made by the typewriter. In printers' Roman, the *f*, *i*, *l* each occupies only about one-third as much horizontal space as an *m*, *M*, *W* of the same type; and there are minute variations in horizontal space between the widths of nearly all other letters, as shown in Illustration 1, in

a|	f|	k|	p|	u|
b|	g|	l|	q|	v|
c|	h|	m|	r|	w|
d|	i|	n|	s|	x|
e|	j|	o|	t|	y|

ILLUSTRATION 1.

which the perpendicular dashes are placed at exactly equal distance from the right-hand side of all letters. Corresponding variation of outline-width is not found in typewriter letters. With each stroke on any key of the mechanical writer the part carrying the paper is moved one-tenth of an inch to the left (this is a standard distance, ten characters to the inch); moves the same distance for the narrowest character as for the widest capital. This statement can be verified by turning up the lower edge of a sheet of genuine typewritten matter (not the average commercial imitation (?) of it in printers' type), and observing that the characters throughout are alined perpendicularly as well as horizontally, like those in Chinese or Japanese books. Each *f*, *i*, *l* occupies as much horizontal space *without filling it* as does *e*, *r*, *n*, *5*, *H*, or any other character, resulting in the "apparently uneven distribution." This is shown in Illustration 2, where, in the first line,

mammilliform
mammilliform

ILLUSTRATION 2.

the juxtaposition of unharmonized characters gives an uncombed appearance to the word in typewriter type, which kind of irregularity, in more or less acute form, is noticeable in every line of typewriting. In the second line the appearance of the same word, set in true-blue Roman, not the pseudo kind, is harmonized, because no character occupies more or less horizontal space than it can properly fill.

Illustration 3 shows the distorted letters in striking contrast in the first two lines. The third and fourth lines consist of letters which normally fill out the unvarying space; and, contrasting their satisfactory appearance with that of the deformities in the first two lines, we find that no apology for an improved typewriter alphabet is necessary.

Typewriting machines have been made with "differential spacing"—in other words, mechanism which provided for different widths of character, for the purpose of producing a closer imitation of printers' Roman. Each of this class of machines has proved a pronounced failure, and there is probably not one on the market to-day. Differential spacing was generally se-

ffffiiiilllmmmmllllmmmm
ffffiiiilllmmmmllllmmmm
conveyancerscondescended
abandonedabandonedabando

ILLUSTRATION 3.

cured at the expense of other qualities of greater importance in a typewriter—speed, endurance, or simplicity. Furthermore, such spacing is undesirable in typewriting, because equal width of letters enables one of them to be erased and another substituted in case of mistake, which can not be done if a narrow character has been "cuffed" into a spot where it doesn't belong. "Differential" spacing is a poor flight against manifest destiny; for typewriter mechanism is right as it is, but the typewriter *Roman* alphabet is wrong.

Evidently, it is impossible to produce a beautiful letter, *book* page or *newspaper* column by either typewriter type or *typewriting* under the dispensation of an unscientific, unadapted Roman alphabet. Under conditions imposed by the mechanical limitations explained, the German alphabet fares even worse, the Russian perhaps a trifle better, than the Roman; the others don't count. If either *f*, *i*, *l*, *m* were phonetically superfluous, like *x*, for instance, the diagnosis would suggest relegation. But each is indispensable to a proper representation of the American language, and the four comprise about one-sixth of all the letters used. Therefore, in the American alphabet the plan is followed of normalizing the outlines of the unadapted letters—that is to say, systematically modifying each unsatisfactory letter in such a way as to make it fill out the regular space, making it more acceptable visually, but not changing it enough to make the print illegible. The eye, in reading, glances naturally along the upper half of the letters, which part generally contains the saliencies, and this portion is practically unchanged; but such modifications are made in the body of the letter as will cause it to fill out the allotted space.

Illustration 4 shows part of a page typewritten in the first American alphabet letters made. Not all the

PRINTING is the art of producing impressions, from characters or figures, on paper or any other sub stance. There are severals disstinct branches of this important art--as the printing of books with movable types, the printing of engraved co pper and steels plates, and the tak ing of impressions from stone,calls ed listhographing. We have now to describe the printing of books or sheets with movable types, generals -ly calsled letter-press printing,

ILLUSTRATION 4.

imperfections have been normalized away, but most of them observable in ordinary typewritten pages have disappeared. It may be interesting to compare this with a typewritten letter, then with a book page.

Matter produced in the American alphabet is typewritable with uneven right-hand margin, as ordinarily, but to satisfy a commendable popular prejudice, parallel margins are shown; the means taken to secure these will engage the reader's attention. Ordinary rules of syllabication and hyphenization were disregarded, the words being divided just as they happened to come. Where the line ended a space short, the gap was filled by an American "evenmark" (any ornamental, unmeaning justifier, of same width as a letter, but which must bear no resemblance to any significant character). In actual typewriting, this character must obviously come at the right end of the line, except in retyping or *reprint;* but in typesetting, it can be inserted at either end, to avoid a perpendicular succession of characters. Two evenmarks can be used; or one, invertible. This device recalls the peculiar words which, meaningless themselves, in a softer clime and under a more brilliant blue impart phrase-symmetry to the lover's appeal and to the orator's fulminations.

Comparing the typographical appearance of a volume printed in the olden time with that of one printed in the present age, we perceive that the modern printer discards many procedures which once governed the production of a book, for the publisher of the now-time looks to a much greater number of readers, and relies on their greater intelligence and knowledge, on educated imagination and superior context-apprehension. Syllabication will be the next to be discarded.

In typewriting thousands of lines like Illustration 4 it was found that less than one-third of the lines ended in unsyllabic divisions, because about one-sixth of them were completed and "justified" by the last letter in a word—no division; another sixth were justified by an evenmark—no division; the numerous paragraphic breaklines ended of course in no division; in poetry, and mathematical, indexical, price list and "one line" matter, the divisions were naturally rare or nonexistent. Where a line ends with a syllable a space

short, it is good to use a hyphen, especially if the syllable is an accented one; and a hyphen can be used to prevent the first division of a divided word from looking like a word by itself.

One of the needs of the age is a definite ratio, a dimension-correspondence, between typewritten manuscripts and the printer's output. Typesetting with American alphabet letters, according to the method shown in Illustration 4, will proceed a third faster than by the present method, in which much time is lost by confining the line in the syllabic straitjacket. The appearance of the matter produced is much finer, as the spacing in each line is exactly the same as that in the line above or below. The space between words will be uniformly the width of a letter—visually the most desirable distance. Each line of any size of type, in any measure, will hold a known number of characters, a great advantage in many composing room operations; and in the preparation of typewritten copy the machine can be margined for a corresponding number of characters to a line, facilitating "ed." measurements, making "outs" and "doubles" almost impossible, and in other ways which cannot be described here expediting matters. As each character occupies the same space as any other, correcting is facilitated. Thin spaces of one—or, at the most, two—different widths provide means for increasing or decreasing the space between words—which, however, is rarely necessary. In short, the American alphabet is an instrument of precision, and presages type-facility of a kind unrealized in any present printing system.

The best "set" of characters is as follows in the four principal sizes:

6 point type,	4 point set;	17 1-3 ems to 26 lower case.
8	5	16 1-4
10	6	15 3-5
12	7	15 1-6

Illustration 4 was produced without printers' type or material of any kind, being simply typewritten, the initial letter pasted in, and the rest being done by the photo-engraver.

THE PREPARATION OF FLUORINE BY ELECTROLYSIS IN AN APPARATUS OF COPPER.

By HENRI MOISSAN.

UP to the present time fluorine has been obtained by the electrolysis of a hydrofluoric solution of fluoride of potassium in a platinum apparatus. Shortly after the commencement of our research we announced that the platinum of the electrodes and of the apparatus was attacked, that a certain quantity of this metal went into solution, and that from this moment the electrolysis became more regular. (Ann. Chim. Phys., [6], xxiv., p. 224.)

The use of platinum, and the wearing of the electrodes and of the vessel, which was fairly rapid, made this apparatus very expensive.

To find out whether it was possible to replace the platinum by another metal, we placed samples of various metallic wires at the bottom of the electrolytic apparatus and proceeded with the preparation of the fluorine in the usual manner. We observed that, of the different metals used in these experiments, the one that was attacked the least was copper, that is, if the acid was perfectly free from water. This fact further agrees very well with the researches made by M. Poulenc on the properties of fluoride of copper. (Ann. Chim. Phys., [7], xix., p. 66.)

In view of these preliminary experiments, we constructed a copper U-tube of as near as possible the same shape as our platinum electrolyzer. Its volume was a little greater, being of about 300 c.c. capacity, and easily permitting the electrolysis of 200 c.c. of hydrofluoric acid, made conducting by means of 60 grms. of hydrofluorate of fluoride of potassium. The method of closing the apparatus was the same, but the shape of the electrodes was changed. In our previous experiments we made use of cylindrical rods of platinum, the ends of which were clubbed; wishing to have a greater surface, we gave the electrodes the form of open hollow cylinders. The surface was increased so as to get a higher return. The electrodes were still of platinum, as for this part of the apparatus we were unable to use copper.

In some experiments made with copper electrodes, the metal went into solution as soon as the electrolysis began, and a badly conducting layer of fluoride of copper, which stopped the current, was quickly deposited on the positive electrode. If the mixture of hydrofluoric acid and fluoride of potassium is entirely free from water, the electrolysis goes on very satisfactorily with platinum electrodes in a copper vessel. Under these conditions this latter will not be attacked. It is probable that the fluorine, which soon goes into solution in the hydrofluoric acid, forms on the surface of the copper a thin layer of this protecting fluoride, of which we have previously spoken, insoluble in hydrofluoric acid.

The return from this apparatus was found by measuring the volume of the hydrogen given off at the negative pole in a certain time. In a series of preliminary experiments, we satisfied ourselves that the volume of oxygen produced by the action of the fluorine on the water corresponded with the volume of hydrogen given off at the positive pole, allowing, of course, for the amount of ozone formed.

With a current of 50 volts and 15 amperes we obtained a return of about 15 liters per hour when the experiment lasted about from six to ten minutes. By using a current of 20 amperes at the same voltage the return was increased to 8 liters, but in the second case the experiment could not be continued for long, owing to the heating of the liquid, and, in spite of an artificial cooling of —50°, the fluorine gas carried off abundant fumes of hydrofluoric acid.

It is also of importance not to lower the temperature too much, or there will be a considerable formation of a compound of hydrofluoric acid with the alkaline fluoride. This new copper apparatus gave very good results in experiments lasting several hours, and we were able to examine several new questions, for which a continuous current of fluorine was necessary.—Bull. Soc. Chim., Ser. 3, xxiii., No. 8.

Ten naval cadets have been assigned to duty at the torpedo station at Newport to receive instruction in wireless telegraphy.

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TABLE OF CONTENTS.

PAGE

I. ARCHÆOLOGY.—Some Vehicles of Antiquity.—5 illustrations.... 20503

II. ASTRONOMY.—The Eclipse of the Sun of May 28.—1 illustration 20500

III. BOTANY AND HORTICULTURE.—New Treatment for the Cryptogamic Maladies of the Vine and of Other Plants.—By Dr. REPIN.... 20503

IV. CHEMISTRY.—The Preparation of Fluorine by Electrolysis in an Apparatus of Copper.—By HENRI MOISSAN.... 20510

V. COMMERCE.—Trade Suggestions from United States Consuls.... 20502

VI. ELECTRICITY.—Indoor Traction.—1 illustration.... 20508
The Electric Locomotive of the Compagnie d'Orleans.—1 illustration.... 20508

VII. EXPOSITIONS.—Agricultural Building and Propylæa at the Pan-American Exposition.—2 illustrations.... 20505

VIII. GEOLOGY.—The Latest Eruption of Mount Vesuvius.—1 illustration.... 20500

IX. MECHANICS.—The Rolling Platform at the Exposition of 1900.—2 illustrations.... 20504

X. MINING.—The Diamond Fields of Russia.... 20505
United States Mineral and Metal Production.... 20506

XI. MISCELLANEOUS.—A Portable Filtering Fountain.—3 illustrations.... 20509

XII. PRINTING.—A Brief History of Early Printing.—5 illustrations.... 20501

XIII. RAILWAYS.—The Trans-Sahara Railway.... 20505

XIV. SOUND.—Inscribing and Reproducing Diagram for Phonographs.—1 illustration.... 20508

XV. TECHNOLOGY.—Mirror Making for Process Workers.... 20503

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Notes on Japan.... 20499

XVII. TYPEWRITING.—A New Typewriter Alphabet.—4 illustrations.—By JACOB BACKES.... 20509

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